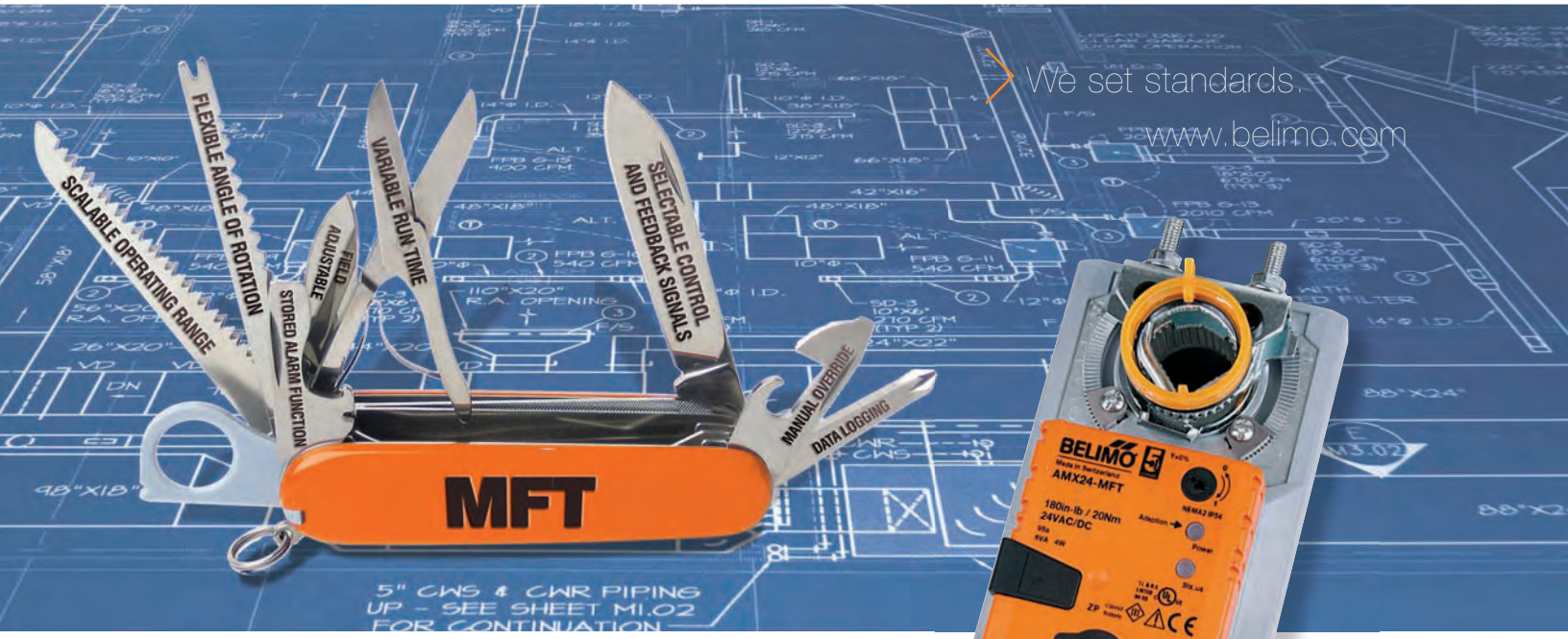
BELIMO

# Technical Documentation
# Multi-Function Technology (MFT)
# for Damper and Control Valve Applications

Effective August 2009

# Multi-Function Technology®
# Your swiss army knife for HVAC.



## Features and benefits only Belimo's MFT can provide.

Multi-Function Technology, only from Belimo, allows you to create custom solutions for individual applications, using the same programmable actuator. Whether you need a particular control or feedback signal, or need to change running speeds, MFT is the answer. It comes standard as a 2 to 10 VDC proportional control but can be reprogrammed on-site. You can modify voltage control, time proportional control, floating point, on/off and feedback signals too. In addition, MFT makes it easy to set parameters for running time, mechanical working range, address, status and diagnostics. Think of it as your all-in-one, swiss army knife for HVAC.

5 YEAR WARRANTY

| Feature | Benefit |
|---|---|
| Configurable control and feedback signal type | Reduced number of actuators required in stock |
| Variable runtime | Flexibility to tune to each application |
| Flexible angle of rotation setting | Customized to fit application - to drive actuator less than 100% open/closed |
| Scalable operating range | Optimized control resolution for every operating range |
| Min, Mid, Max override function | Additional system control beyond modulation |
| Stored alarm information | Ease troubleshooting |
| Data logging capability | Gather system data for optimization or diagnostics |

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# MULTI-FUNCTION TECHNOLOGY

Belimo damper actuators and control valves with Multi-Function Technology (MFT) are an excellent way to standardize your product line while reducing the number of different actuators needed. Multi-Function Technology offers a wide variety if programmable control inputs and feedback signals. Parameters can be set for voltage control (VDC), time proportional control (PWM), floating point, on-off, feedback signal, or torque output. Parameters can be changed on-site to optimize/enable application. You can also set, modify or read position, running time, mechanical working range, address, status, and diagnostics.

MFT offers tailor made solutions allowing you to adapt the actuator of valve to your system for replacement and to improve system functionality.

# BELIMO PC-TOOL

## Laptop access anywhere.
## Universal Access to all MFT actuators.

The PC-Tool is a universal software application for setting, commissioning, monitoring and evaluating communications with Belimo actuators. Actuators are normally delivered with the basic settings. They can be individually programmed using the PC-Tool and precisely adjusted to the requirements of the system. Service related diagnostics for the actuators are extremely easy with the PC-Tool. Setpoints can be specified and actual values monitored The trend recording function can output the information in a graphical format for system documentation.

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| B2 | 50 | AR | X | 24 | -MFT | |
|---|---|---|---|---|---|---|
| **Valve**<br>B2 = 2-Way<br>B3 = 3-Way<br>B6 = 2-Way Flanged | **Valve Size**<br>07-80 = 1/2"- 3" | **Torque Rating**<br>Non-Spring Return<br>GM = 360 in-lb<br>AM = 180 in-lb<br>NM = 90 in-lb<br>LM = 45 in-lb<br>LU = 27 in-lb<br>AH = 220 lbf<br>LH = 100 lbf<br>Spring Return<br>AF = 133 in-lb<br>NF = 60 in-lb<br>LF = 35 in-lb<br>TF = 18 in-lb | **Version**<br>X* = Customized Cable<br>10 ft (3m)<br>16 ft (5m)<br>Run Time<br>Variable | **Power Supply**<br>24 = 24 VAC/DC<br>120 = 120 to 230 VAC | **Control**<br>-MFT = Multi-Function Technology<br>-MFT95 = 0-135 Ω | -S = Built-in Auxiliary Switch |

* Only available on Non-Spring

## Ordering Example

**1** Choose the valve actuator combination.

**B250+ARX24-MFT** | **+NO** | **+Tagging (if needed)**

**2** Specify preference or configuration.

**3** **For MFT orders only - select programming code**

**4** Does order require tagging?

Set-Up

Non-Spring Models
**NO** = Normally Open
**NC** = Normally Closed

Spring Return Models
**NO/FO** = Normally Open/Fail Open
**NO/FC** = Normally Open/Fail Closed

**NC/FO** = Normally Closed/Fail Open
**NC/FC** = Normally Closed/Fail Closed

Refers to valve ports A to AB.

P-10001 (A01)

| | |
|---|---|
| P-100xx (Axx) | Control voltage applications |
| P-200xx (Wxx) | Pulse width modulation applications |
| P-300xx (Fxx) | Floating Point applications |
| P-400xx (Jxx) | On/Off applications |
| X-XXXXX | Create custom MFT configuration code |
| X-XXXXX | Create custom MFT configuration in the field with MFT-actuator PC software |

Tagging:
Valves may be tagged per customer specification.

Example:
AHU-1
FCU-2

**5** Complete Ordering Example: B250+ARX24-MFT+NO+A01

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| | Control | Parameter Variables | Description |
|---|---|---|---|
| Input | **VDC** | • Start: 0.5 to 30 VDC<br>• Stop: 2.5 to 32 VDC<br>(Minimum 2 VDC between start and stop required) | P-100…(A…) configuration types are used for VDC control applications. Pre-set configurations are listed which offer solutions for standard control applications. Additional pre-set configurations are list which offer solutions for non-standard control application for:<br>• Sequencing Actuators<br>• Adjustable Start and Stop Points<br>• Combination for Master Slave |
| | **Pulse Width Modulation (PWM)** | PWM Range<br>• 0.02 to 50 sec. range minimum interval<br>• 20 [ms] between pulses<br>• Minimum cycle duration 520 [ms] | P-200… (W…) configuration types are used for pulse width modulation control outputs with four standard ranges. There must be at least one second between the min pulses allowed (0.02 sec.) and the max pulse allowed (50 sec.). (eg: 0.02 to 1.02 sec.) |
| | **Floating Point** | | P-300… (F...) configuration types are used for floating point control outputs. In this application MFT actuators offer constant running time and standard feedback options. A 1N4004 diode is required for spring return actuators. The actuator is designed to recognize the rectified voltage as an opposite control signal request. |
| | **On/Off** | | P-400… (J…) configuration types are used for on/off control outputs. The configuration allows for service replacement of on/off actuators when a true on/off actuator is not available. In addition the MFT actuator offers additional functionality in the on/off mode, such as configuration P-40003 (J03) with minimum position and 2 to 10 VDC feedback. |
| Feedback | **Position Feedback** | Position Feedback Range<br>• Start: 0.5 to 8 VDC Selectable<br>• Stop: 2 to 10 VDC Selectable | The default-operating mode of the U5 output is 2 to 10 VDC for position feedback. |
| Sensitivity | **Control Sensitivity** | Normal (Default) | MFT actuators are designed with a unique non-symmetrical dead band. The actuator follows an increasing control signal with a 80 mV resolution. If the signal changes in the opposite direction, the actuator will no respond until the control signal changes by 200 mV. This allows the actuator to track even the slightest deviation very accuratly, yet allowing the actuator to "wait" for a much larger change in control signal. For quick actuators the values are half. |
| | | Reduced | Upon detecting an un-stable control loop, the "reduced" setting can be manually selected via the PC software. This will reduce the sensitivity of the actuator by 50%.<br>Meaning, control accuracy will now be 160 mV for signal changes in the same direction. And a 400 mV signal change in the opposite direction is needed for the actuator to change direction. Once driving in the opposite direction the actuator will respond in 160 mV increments.<br>Upon improving the control loop stability you can return the actuator to the "Normal" mode. |

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# Spring Return Actuator Product Range
# Multi-Function Technology

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| | | Running Time | | Power Supply | | | Power Consumption | | Control Input | | | Control Input MFT | | | | Position Feedback | | Auxiliary Switches | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Motor Drive, (Default) (…-MFT US, 75 to 300 sec., fully programmable by Belimo or in field) | Spring Return | 24 VAC +/- 20%, VDC +/- 10%, 50/60 HZ | 120 VAC +/- 10% | 230 VAC +/- 10% | VA Rating, Transformer Sizing | Wattage Running (Holding) | 2-10 VDC (Default) 4-20 mA* (w/500 Ω Resistor) | 6 - 9 VDC, 20 VDC Output Voltage | Honeywell Series 90, 0-135 Ω | On/Off | Floating Point | Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC | PWM adj., 0.02 to 50.0 Seconds | 2-10 VDC (Default) | VDC Variable, Start 0 to 8, Span 2 to 10 VDC | 1 SPDT, 3 A (0.5 A inductive) @250V | 2 SPDT, 7 A (2.5 A inductive) @ 250V |
| **AF Series**<br>133 in-lb [15 Nm]<br>Approx. 33 sq. ft. | AF24-MFT US† | 75…300 (150) | <20 | ● | | | 10 | 6.0 (2.5) | ● | | | ● | ● | ● | ● | ● | ● | | |
| | AF24-MFT-S US† | 75…300 (150) | <20 | ● | | | 10 | 6.0 (2.5) | ● | | | ● | ● | ● | ● | ● | ● | | ● |
| | AF24-MFT95 US† | 75…300 (150) | <20 | ● | | | 10 | 6.0 (2.0) | | | ● | | | | | ● | ● | | |
| **NF Series**<br>60 in-lb [7 Nm]<br>Approx. 15 sq. ft. | NF24-MFT US | 75…300 (150) | <60 | ● | | | 6 | 3.0 (1.8) | ● | | | ● | ● | ● | ● | ● | ● | | |
| **LF Series**<br>35 in-lb [4 Nm]<br>Approx. 8 sq. ft. | LF24-MFT US | 75…300 (150) | <25♦ | ● | | | 5 | 2.5 (1.0) | ● | | | ● | ● | ● | ● | ● | ● | | |
| | LF24-MFT-S US | 75…300 (150) | <25♦ | ● | | | 5 | 2.5 (1.0) | ● | | | ● | ● | ● | ● | ● | ● | ● | |
| | LF24-MFT-20 US | 150 | <25♦ | ● | | | 6 | 3.5 (1.5) | | ● | | ● | ● | ● | ● | ● | ● | | |
| | LF24-MFT-S-20 US | 150 | <25♦ | ● | | | 6 | 3.5 (1.5) | | ● | | ● | ● | ● | ● | ● | ● | ● | |
| **TF Series**<br>18 in-lb [2 Nm]<br>Approx. 4.5 sq. ft. | TF24-MFT US | 75…300 (150) | <25♦ | ● | | | 4 | 2.0 (1.0) | ● | | | ● | ● | ● | ● | ● | ● | | |

♦ <60 seconds @ -22°F [-30°C].

† Dual mounting on a single shaft (on/off wired in parallel), (-SR, -MFT wired master slave). Please call Belimo customer service for details.

NOTE: Some spring and non-spring damper actuators are also used for water applications. A linkage connects the actuators to the valve. Some of the valves, such as the PICCV use a running time of 100 seconds. Some actuators end with an X1 such as AMX24-MFTX1.

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| | | Custom Options | | Running Time | Power Supply | | Power Consumption | | Control Input | | Control Input MFT | | | | Position Feedback | | Auxiliary Switches | NEMA 4X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 ft (3m) cable / 16 ft (5m) cable | Terminal strip NEMA 1/IP20 / 2/IP54 | Motor Drive Range, (Default) ...-MFT Fully Programmable | 24 VAC +/- 20%, VDC +/- 10% | 100 to 240 VAC | VA Rating | Wattage Running (Holding) | 2-10 VDC (Default) 4-20 mA (w/500 Ω Resistor) | Honeywell Series 90, 0-135 Ω | On/Off | Floating Point | Start and Span adj., Start 0.5 to 30 VDC, Span 2.5 to 32 VDC | PWM adj., 0.02 to 50.0 Seconds | 2-10 VDC (Default) | VDC Variable, Start 0 to 8, Span 2 to 10 VDC | Add-on | Enclosure (Part No. +N4 or +N4H) |
| **GMX Series** 360 in-lb [40 Nm] Approx. 90 sq. ft. | GMX24-MFT† | ● | | 100-300 (150) | ● | | 7 | 4.0 (1.5) | ● | | ● | ● | ● | ● | ● | ● | ● | |
| | GMX24-MFT95† | ● | | 100-300 (150) | ● | | 7 | 4.0 (1.5) | | ● | | | | | ● | ● | ● | |
| **AMX Series** 180 in-lb [20 Nm] Approx. 45 sq. ft. | AMX24-MFT | ● | | 90-300 (150) | ● | | 6 | 3.5 (1.3) | ● | | ● | ● | ● | ● | ● | ● | ● | ● |
| | AMCX24-MFT | ● | | 35-120 (35) | ● | | 6 | 3.5 (1.3) | ● | | ● | ● | ● | ● | ● | ● | ● | |
| | AMX24-MFT95 | ● | | 90-150 (150) | ● | | 6 | 3.5 (1.3) | | ● | | | | | ● | ● | ● | |
| **AMQ Series** 140 in-lb [16Nm] | AMQX24-MFT | ● | | 7-15 (7) | ● | | 18 | 12 (1.5) | ● | | ● | ● | ● | ● | ● | ● | ● | |
| **NMX Series** 70 in-lb [8 Nm] Approx. 22 sq. ft. | NMX24-MFT | ● | | 150 | ● | | 6 | 3.5 (1.3) | ● | | ● | ● | ● | ● | ● | ● | ● | ● |
| | NMX24-MFT95 | ● | | 45-150 (150) | ● | | 6 | 3.5 (1.3) | | ● | | | | | ● | ● | ● | |
| | NMCX24-MFT | ● | | 20-75 (20) | ● | | 5 | 3.0 (0.6) | ● | | | | | | ● | ● | ● | |
| **NMQ Series** 70 in-lb [8Nm] | NMQX24-MFT | ● | | 4-20 (4) | ● | | 18 | 12 (1.5) | ● | | ● | ● | ● | | ● | ● | ● | |
| **LMX Series** 35 in-lb [4 Nm] Approx. 11 sq. ft. | LMX24-MFT | ● | | 35-200 (150) | ● | | 5 | 2.5 (1.2) | ● | | ● | ● | ● | ● | ● | ● | ● | |
| | LMX24-MFT95 | ● | | 35-150 (150) | ● | | 5 | 2.5 (1.2) | | ● | | | | | ● | ● | ● | |
| **LMQ Series** 35 in-lb [4Nm] | LMQX24-MFT | ● | | 2.5-10 (2.5) | ● | | 18 | 12 (1.5) | ● | | ● | ● | ● | | ● | ● | ● | |
| **AHX Series** 101 lbf [450 N Force] 4" or 8" stroke | AHX24-MFT* | ● | | 150* | ● | | 6 | 3.5 (1.3) | ● | | ● | ● | ● | ● | ● | ● | | |
| **AHQ Series** 44 lbf [200 N Force] | AHQX24-MFT-100 | ● | | 7-30 (7)* | ● | | 18 | 12 (1.5) | ● | | ● | ● | ● | ● | ● | ● | | |
| **LHX Series** 34 lbf [150 N Force] 4" or 8" stroke | LHX24-MFT* | ● | | 75-150 (150)* | ● | | 5 | 2.5 (1.2) | ● | | ● | ● | ● | ● | ● | ● | | |
| **LHQ Series** 22 lbf [100 N Force] | LHQX24-MFT-100 | ● | | 3.5-15 (3.5)* | ● | | 18 | 12 (1.5) | ● | | ● | ● | ● | | ● | ● | | |
| **LUX Series** 27 in-lb [3 Nm] | LUX24-MFT | ● | | 75-150 (150) | ● | | 5 | 2.5 (1.2) | ● | | ● | ● | ● | ● | ● | ● | | |

* The LH and AH linear series actuators come in three different stroke lengths [4, 8 or 12 in]. The part number is followed by -100, -200, -300 respectively. The default running time is 150 seconds per 4 inches [100 mm]. Running time is adjustable depending on model:
LH Series: 70-270, 140-540, 200-810, on the -100, -200, -300 models respectively.
AH Series: 150-600, 300-1200, 450-1800, on the -100, -200, -300 models respectively.

LHQ and AHQ available in 4 inch version only.

† Dual mounting on a single shaft is possible for higher torque (-3 and -SR wired in parallel), (-MFT wired Master-Slave). Please call Belimo customer service for details.

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# Pre-Set MFT Configurations

## DC Voltage Control

### Spring Return Actuators

| | |
|---|---|
| AF24-MFT(-S) US | 133 in-lb |
| NF24-MFT US | 60 in-lb |
| LF24-MFT(-S) US | 35 in-lb |
| LF24-MFT(-S)-20 US | 35 in-lb |
| TF24-MFT US | 18 in-lb |

### Non-Spring Return Actuators

| | |
|---|---|
| GMX24-MFT | 360 in-lb |
| AMX24-MFT | 180 in-lb |
| NMX24-MFT | 90 in-lb |
| LMX24-MFT | 45 in-lb |
| AMQX24-MFT | 140 in-lb |
| NMQX24-MFT | 70 in-lb |
| LMQX24-MFT | 35 in-lb |
| AHX24-MFT | 101 lbf |
| AHQX24-MFT-100 | 44 lbf |
| LHX24-MFT | 34 lbf |
| LHQX24-MFT-100 | 22 lbf |
| LUX24-MFT | 27 in-lb |

### Application

How the MFT actuator performs is determined by the configuration (P-10001, A01). The old generation actuators used a P-code (P-10001). The new generation actuators use a shorter 3 digit code. This shorter code is displayed on the reorder number.

P-1000... configuration types are used for control voltage applications.

Additional pre-set configurations are listed which offer solutions for non-standard control application for:

- Adjustable Start and Stop points
- Sequencing actuators
- Combination for master slave (see page 19.)

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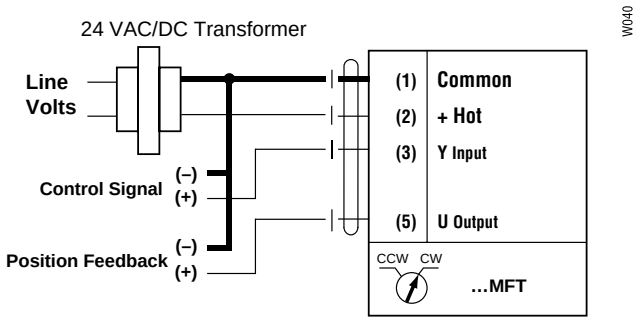
### Wiring Diagram




VDC

### Select Configuration

| | Configuration | Code | Input Range | Position Feedback | Running Time | Torque % | Adaptation |
|---|---|---|---|---|---|---|---|
| Voltage | **P-10001*** | **A01** | **2.0 to 10.0 VDC** | **2.0 to 10.0 VDC** | **150** | **100** | **MANUAL** |
| | P-10002 | A02 | 0.5 to 10.0 VDC | 0.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10003 | A03 | 2.0 to 10.0 VDC | 0.0 to 5.0 VDC | 150 | 100 | MANUAL |
| | P-10004 | A04 | 4.0 to 7.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10005 | A05 | 6.0 to 9.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10006 | A06 | 10.5 to 13.5 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10007 | A07 | 0.5 to 5.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10008 | A08 | 0.5 to 5.0 VDC | 0.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10009 | A09 | 5.0 to 10.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10010 | A10 | 5.0 to 10.0 VDC | 0.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10013 | A13 | 0.5 to 10.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10015 | A15 | 2.0 to 5.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10016 | A16 | 2.0 to 6.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10017 | A17 | 6.0 to 10.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10018 | A18 | 14.0 to 17.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10020 | A20 | 9.0 to 12.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10028 | A28 | 0.5 to 10.0 VDC | 0.0 to 10.0 VDC | 100 | 100 | MANUAL |
| | P-10031 | A31 | 0.5 to 4.0 VDC | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10063 | A63 | 0.5 to 4.5 VDC | 0.5 to 4.5 VDC | 150 | 100 | MANUAL |
| | P-10064 | A64 | 5.5 to 10.0 VDC | 5.5 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-10091 | A91 | 2.0 to 10.0 VDC | 2.0 to 10.0 VDC | 95 | 100** | MANUAL |

* P-10001 (A01) is the default configuration code.
** Reduced torque in Spring Return (see page 19)

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### Spring Return Actuators

| | |
|---|---|
| AF24-MFT(-S) US | 133 in-lb |
| NF24-MFT US | 60 in-lb |
| LF24-MFT(-S) US | 35 in-lb |
| LF24-MFT(-S)-20 US | 35 in-lb |
| TF24-MFT US | 18 in-lb |

### Non-Spring Return Actuators

| | |
|---|---|
| GMX24-MFT | 360 in-lb |
| AMX24-MFT | 180 in-lb |
| NMX24-MFT | 90 in-lb |
| LMX24-MFT | 45 in-lb |
| AH24-MFT | 101 lbf |
| LH24-MFT | 44 lbf |
| LUX24-MFT | 27 in-lb |

## Application

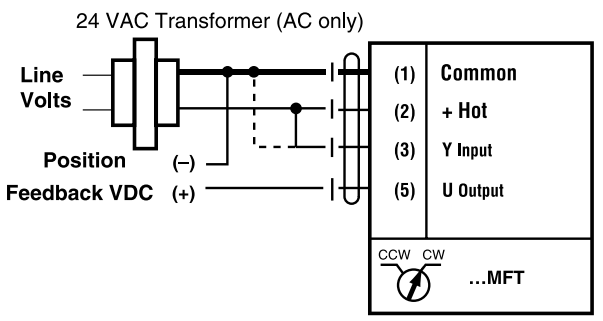
How the MFT actuator performs is determined by the configuration (P-10001, A01). The old generation actuators used a P-code (P-10001). The new generation actuators use a shorter 3 digit code. This shorter code is displayed on the reorder number.

P-2000… configuration types are used for Pulse Width Modulation control outputs. Most D.D.C. controllers have digital outputs which incorporate a default PWM range.

This enables a D.O. to be used as a proportional output when needed. Simply select the appropriate configuration code according to your application.

LISTED 94 D5 TEMP. IND. & REG. EQUIP.

## Wiring Diagram




**PWM, Triac Source and Sink**

## Select Configuration

| | Configuration | Code | Input Range | Position Feedback | Running Time | Torque % | Adaptation |
|---|---|---|---|---|---|---|---|
| Pulse Width Modulation | P-20001 | W01 | 0.59 to 2.93 sec | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-20002 | W02 | 0.02 to 5.00 sec | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-20003 | W03 | 0.10 to 25.50 sec | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-20004 | W04 | 0.10 to 25.60 sec | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-20005 | W05 | 0.10 to 5.20 sec | 0.0 to 5.0 VDC | 150 | 100 | MANUAL |
| | P-20012 | W12 | 0.50 to 25.50 sec | 0.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-20013 | W13 | 0.50 to 2.93 sec | 0.0 to 5.0 VDC | 150 | 100 | MANUAL |
| | P-20014 | W14 | 0.10 to 10.00 sec | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |

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# Pre-Set MFT Configurations

## Floating Point Control

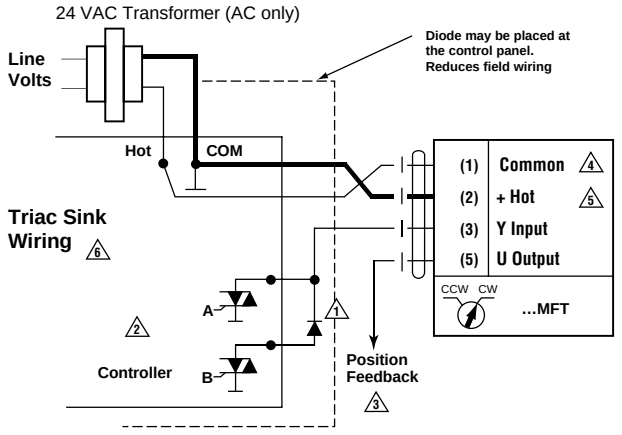
### Spring Return Actuators

| | |
|---|---|
| AF24-MFT(-S) US | 133 in-lb |
| NF24-MFT US | 60 in-lb |
| LF24-MFT(-S) US | 35 in-lb |
| LF24-MFT(-S)-20 US | 35 in-lb |
| TF24-MFT US | 18 in-lb |

### Non-Spring Return Actuators

| | |
|---|---|
| GMX24-MFT | 360 in-lb |
| AMX24-MFT | 180 in-lb |
| NMX24-MFT | 90 in-lb |
| LMX24-MFT | 45 in-lb |
| AHX24-MFT | 101 lbf |
| LHX24-MFT | 34 lbf |
| LUX24-MFT | 27 in-lb |

### Wiring Diagram



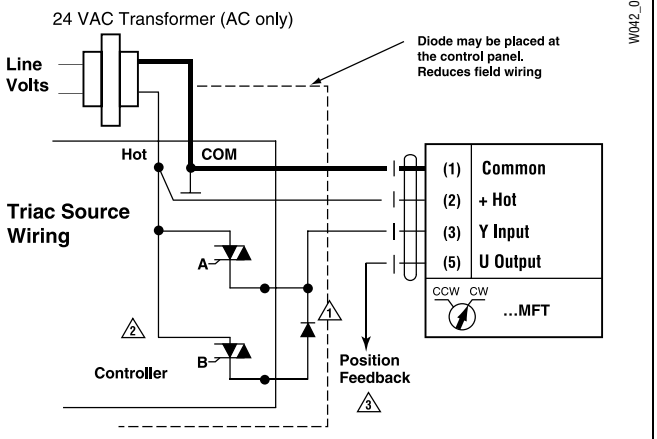

**NOTE:** Diode is internal on non-spring return type actuators, connect to controller using wires 3 & 4.

### Application

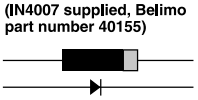
How the MFT actuator performs is determined by the configuration (P-10001, A01). The old generation actuators used a P-code (P-10001). The new generation actuators use a shorter 3 digit code. This shorter code is displayed on the reorder number.

P-3000… configuration types are used for floating point control outputs. In this application MFT actuators offer constant running time and standard feedback options. A IN4004 or IN4007 diode is required for spring return actuators only.

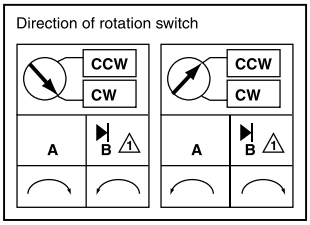
### Wiring Diagram




1 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155)



Direction of rotation switch




2 Triac A and B can also be contact closures.

Why is a diode required? The actuator is designed to recognize the rectified voltage as an opposite control signal request.

3 Position feedback cannot be used with a Triac sink controller. The actuators internal common reference is not compatible.

4 The Common connection from the actuator must be connected to the Hot Connection of the controller.

5 The actuator Hot must be connected to the control board Common.

6 MFT actuators are compatible with contact closure, triac source and triac sink type contollers.

### Floating Point

**NOTE:** Diode is internal on non-spring return type actuators, connect to controller using wires 3 & 4.

### Select Configuration

| | Configuration | Code | Input Range | Position Feedback | Running Time | Torque % | Adaptation |
|---|---|---|---|---|---|---|---|
| Floating Point Control | P-30001 | F01 | Floating Point | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-30002 | F02 | Floating Point | 0.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-30003 | F03 | Floating Point | 2.0 to 10.0 VDC | 100 | 100 | MANUAL |
| | P-30004 | F04 | Floating Point | 0.0 to 5.0 VDC | 100 | 100 | MANUAL |
| | P-30005 | F05 | Floating Point | 0.0 to 10.0 VDC | 100 | 100 | MANUAL |
| | P-30006 | F06 | Floating Point | 0.0 to 5.0 VDC | 150 | 100 | MANUAL |
| | P-30007 | F07 | Floating Point | 2.0 to 10.0 VDC | 300 | 100 | MANUAL |
| | P-30008 | F08 | Floating Point | 2.0 to 10.0 VDC | 75 | 100* | MANUAL |
| | P-30009 | F09 | Floating Point | 2.0 to 10.0 VDC | 85 | 100* | MANUAL |
| | P-30010 | F10 | Floating Point | 0.0 to 2.5 VDC | 150 | 100 | MANUAL |

* Reduced torque in Spring Return (see page 19)

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### Spring Return Actuators

| | |
|---|---|
| AF24-MFT(-S) US | 133 in-lb |
| NF24-MFT US | 60 in-lb |
| LF24-MFT(-S) US | 35 in-lb |
| TF24-MFT US | 18 in-lb |

### Non-Spring Return Actuators

| | |
|---|---|
| GMX24-MFT | 360 in-lb |
| AMX24-MFT | 180 in-lb |
| NMX24-MFT | 90 in-lb |
| LMX24-MFT | 45 in-lb |
| AMQX24-MFT | 140 in-lb |
| NMQX24-MFT | 70 in-lb |
| LMQX24-MFT | 35 in-lb |
| AHX24-MFT | 101 lbf |
| AHQX24-MFT-100 | 44 lbf |
| LHX24-MFT | 34 lbf |
| LHQX24-MFT-100 | 22 lbf |
| LUX24-MFT | 27 in-lb |

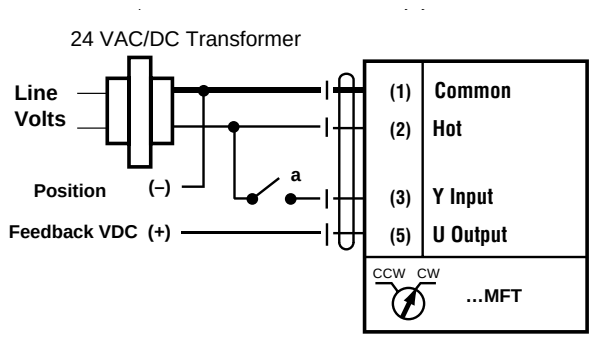
### Application

How the MFT actuator performs is determined by the configuration (P-10001, A01). The old generation actuators used a P-code (P-10001). The new generation actuators use a shorter 3 digit code. This shorter code is displayed on the reorder number.

P-4000… configuration types are used for on/off control outputs. The configuration allows for service replacement of on/off actuators when a true on/off actuator is not available.

In addition the MFT actuator offers additional functionality in the on/off mode, such as configuration P-40003 with minimum position and 2 to 10 VDC feedback.

### Wiring Diagram




On/Off

### Select Configuration

| | Configuration | Code | Input Range | Position Feedback | Running Time | Torque % | Adaptation |
|---|---|---|---|---|---|---|---|
| On/Off Control | P-40001 | J01 | On/Off | 2.0 to 10.0 VDC | 75 | 100* | MANUAL |
| | P-40002 | J02 | On/Off | 2.0 to 10.0 VDC | 150 | 100 | MANUAL |
| | P-40003 | J03 | On/Off | 2.0 to 10.0 VDC | 75 | 100* | MANUAL |
| | P-40004 | J04 | On/Off | 0.0 to 5.0 VDC | 100 | 100 | MANUAL |
| | P-40005 | J05 | On/Off | 0.0 to 10.0 VDC | 100 | 100 | MANUAL |

* Reduced torque in Spring Return (see page 19)

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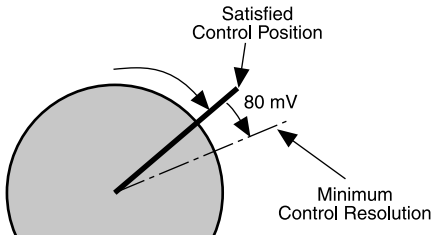
# All MFT actuators have built-in brushless DC motors which provide better accuracy and longer service life.

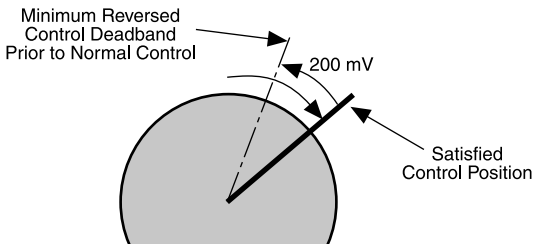
### Control Accuracy and Stability (AF / NF / LF / TF)

The …MFT US actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 80 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 200 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**AF / NF / LF / TF Actuators responds to a 80 mV signal when not changing direction from stop position.**



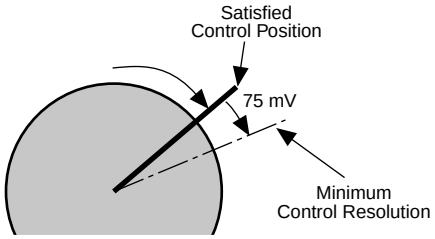

**AF / NF / LF / TF Actuators responds to a 200 mV signal when reversing direction from stop position.**



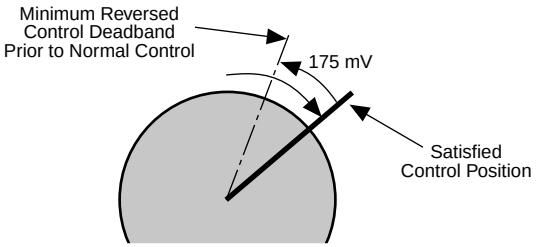

### Control Accuracy and Stability (GM / AM / NM / LM / AH / LH / LU / GR / AR / LR)

Belimo non-spring return actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 75 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 175 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**Actuator responds to a 75 mV signal when not changing direction from stop position.**




**Actuator responds to a 175 mV signal when reversing direction from stop position.**

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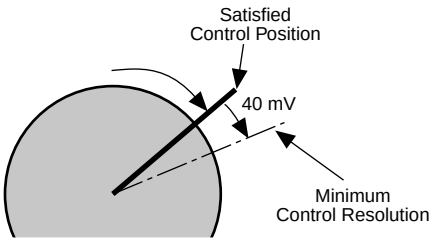
# All Belimo actuators have built-in brushless DC motors which provide better accuracy and longer service life.

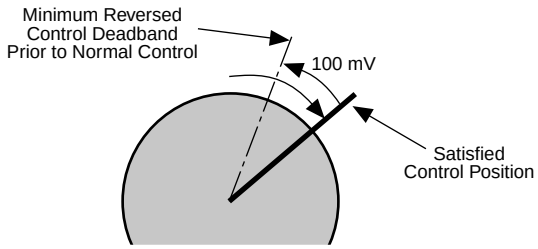
## Control Accuracy and Stability (AMQ / NMQ / LMQ / AHQ / LHQ)

Belimo Quick Running non-spring return actuators are designed with a unique non-symmetrical deadband. The actuator follows an increasing or decreasing control signal with a 40 mV resolution. If the signal changes in the opposite direction, the actuator will not respond until the control signal changes by 100 mV. This allows these actuators to track even the slightest deviation very accurately, yet allowing the actuator to "wait" for a much larger change in control signal due to control signal instability.

**Actuator responds to a 40 mV signal when not changing direction from stop position.**




**Actuator responds to a 100 mV signal when reversing direction from stop position.**

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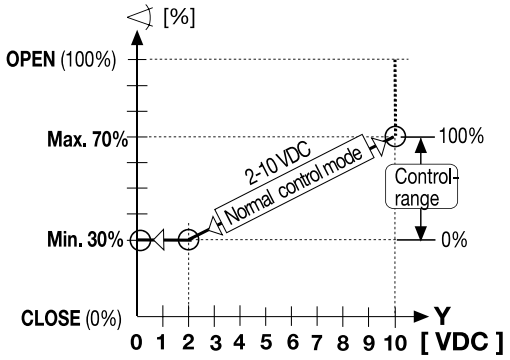
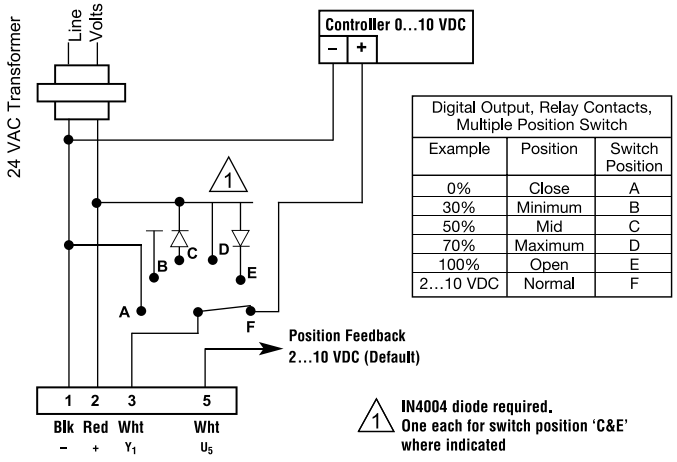
| | Motion | Parameter Variables | Description |
|---|---|---|---|
| Running Time | **AF / NF / LF / TF** | 75 to 300 seconds | Running time is selectable allowing for customizing the actuator for the application at hand. Adjustable running time allows for:<br>• Matching HVAC system sequence of operation.<br>• Improving control loop stability.<br>• Reducing actuating noise (slower running).<br>• Retrofit applications<br>The running time is constant and independent of load. |
| | **GM** | 100 to 300 seconds | |
| | **AM*** | 90 to 350 seconds | |
| | **NM*** | 45 to 150 seconds | |
| | **AH*** | 75 to 150 seconds | |
| | **LM*** | 35 to 150 seconds | |
| | **LH*** | 75 to 150 seconds | |
| | **LU** | 75 to 150 seconds | |
| Rotation | **Direction of Rotation** | Default or Reversed | The direction of rotation can be "Direct" or "Reverse" acting of the control signal. The direction of rotation is selected from a CW and CCW switch located on the actuator.<br>An alternative method of changing the direction of rotation is to use the PC-Tool software. This option allows you to make remote set-up corrections without having the need to be at the actuator.<br>Selection of the direction of rotation is only possible via the PC-Tool software or manually with the switch on the actuator. Selection via a preset configuration is not an option. |
| | **Intermediate Position Control** (Override Control) | • Minimum Position (Default 0%)<br>• Intermediate Position (Default 50%)<br>• Maximum Position (Default 100%)<br>Intermediate Positions are achieved through 'forced override' positions.<br>**SEE FIGURE A – FORCED OVERRIDES.** | All intermediate settings are adjustable from 0 to 100%. Programmed as default, these control positions are possible by using the wiring diagram in **FIGURE A.** The override functions can be used as a means to test the actuator's functionality during equipment servicing or troubleshooting. Intermediate positions can also be integrated into the control circuit as a part of the sequence of operation.<br>The Min, Mid, and Max positions can be used in any MFT control mode.<br>• VDC: For stand-alone controllers where a minimum position is needed.<br>• PWM: Eliminate add-on accessories.<br>• Floating Point: New functionality to a common application.<br>• On/Off: New functionality to a common application.<br>– Satisfy combustion air requirements or boiler sequencing with O/A damper.<br>– Eliminates secondary minimum position dampers. |

* Quicker running actuators are available. Contact Belimo Customer Service for details.

**FIGURE A – Forced Overrides**




Full control signal range is maintained between min and max rotation positions.
i.e.: AM24-MFT on Belimo CCV, adjusting actuator to damper flow characteristics.




| Digital Output, Relay Contacts, Multiple Position Switch | | |
|---|---|---|
| Example | Position | Switch Position |
| 0% | Close | A |
| 30% | Minimum | B |
| 50% | Mid | C |
| 70% | Maximum | D |
| 100% | Open | E |
| 2...10 VDC | Normal | F |

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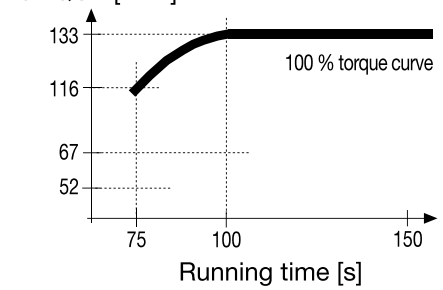
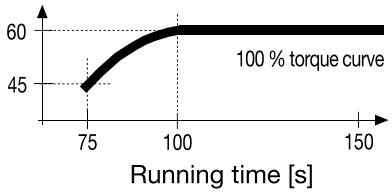
| | Motion | Parameter Variables | Description |
|---|---|---|---|
| | **Adaptation** | OFF | When the manual override button is depressed, and released, the actuator will perform synchronization. The actuator will simply drive to the mechanical zero position and return to its last control position. |
| | | ON – Manual | The default setting for adaptation is "ON – Manual".<br>When the ON-Manual setting is selected, adaptation is initiated by:<br>• Pressing the manual override button twice (GM / AM / NM / LM).<br>• Clicking the CW/CCW switch twice (AF, NF, LF and TF).<br>When adaptation is selected, (On-Manual or Automatic) the actuator will drive one full cycle to its mechanical end stops OR the valves mechanical seats. Upon completion of this cycle the actuators working range (input, feedback and running time) will be adapted to the actual mechanical angle of rotation. |
| | | ON – Automatic | When the ON-Automatic setting is selected at every power-up the actuator will automatically adapt to the mechanical angle of rotation. Also upon pressing the manual override button or CW/CCW switch, adaptation is initiated (See above). |
| **Mechanical Relationship** | **Sound and Running Time** | All Actuators | As the speed of the actuator increases, there is an increase in the sound power level. |
| | **Torque and Running Time** | Spring Return (AF / NF / LF) | Though the running time remains constant, at approximately the 100-second range there is a loss in output torque. This is due to the association of runtime to torque. To gain a faster running time there is a loss in torque. **SEE FIGURE B.** |

**FIGURE B – Torque and Run Time**

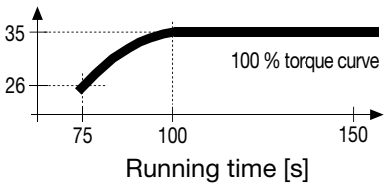
**Torque and Run Time, AF24-MFT US**




**Torque and Run Time, NF24-MFT US**




**Torque and Run Time, LF24-MFT US**




**NOTE: All non-spring return actuators are torque independent of speed.**

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| Specifications | Parameter Variables | Description |
|---|---|---|
| **Alarms - Fault**<br>A fixed voltage of 8.5 VDC is present when Alarm 'sounds'. | Hunting<br>$\frac{A_t(h) \times 100}{O_t(h)}$ = Motion Percentage<br>$\frac{140 \times 100}{700}$ = 20% | Alarm criteria: Actuator is hunting due to unstable control loop.<br>This fault occurs when the ratio of Active time to Operating time exceeds 20%.<br>Operating time: Total number of hours connected to power supply Active time: Total number of hours the actuator is in mechanical motion. |
| | Mechanical Overload | Alarm criteria: Actuator is in a position and not responding to the control input. An alarm will 'sound' when an object or circumstance is preventing the motion of the actuator, damper or valve. The actuator has initiated its own overload protection after a period of 13 seconds. |
| | Mechanical Travel | Alarm criteria: Actuator is adapted to the working angle of a damper or to the stroke of a valve and is less than 95-degree actuator rotation (eg. 75° adapted angle). An alarm will 'sound' when the actuator detects a mechanical travel difference of 10% above the adapted angle (eg. 82.6°). |
| **Alarm - Maintenance**<br>A fixed voltage of 5.5 VDC is present when Alarm 'sounds'. | Mechanical load limit<br>(Non-Sprlng Return Only) | Alarm criteria: The torque load of the application has exceeded the actuator's torque.<br>A typical scenario – the torque requirements has increased due to:<br>• Lack of lubrication<br>• Increased flow<br>• Improper installation<br>• Damage<br>• Dirt and debris build-up<br>The alarm 'sounds' when the specified torque rating of the actuator has been exceeded for a period of 5 seconds. |

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| | Service | Parameter Variables | Description |
|---|---|---|---|
| Displays | **Identification** | Serial Number | Displays the actuators internal serial number. |
| | | Actuator Type / Software Version | Displays the actuator nomenclature (AF24-MFT US) and MFT software version. |
| | | Assembly Location | Displays the where the actuator was assembled. |
| | | Setpoint | Displays the actual control input position as a percentage. As signal input changes you will see the setpoint percentage change accordingly. |
| | **Actual Values** | Actual Position | Displays the actual position as a percentage. As the setpoint changes the actual position percentage will increase or decrease accordingly. If the actuator is capable of rotating the damper or valve, this can be of benefit when troubleshooting an application. |
| | **Function** | Control Type & Setting | Displays the actual control type and operating range. |
| | | Feedback Type & Setting | Displays the actual feedback signal type and operating range. |
| | | Torque % Setting | Displays the actual torque setting, as a percentage of minimum torque. |
| | | Running Time | Displays the actual running time as programmed in seconds. |
| | | Direction of Rotation | Displays the status of the direction of rotation option (Normal or Reversed). |
| | | Min, Mid, Max Position | Displays the actual position setting of the Intermediate position control. |
| | | Adaptation | Displays the actual setting of the adaptation function (OFF, ON-Manual, ON-Automatic). |
| | | Sensitivity / Hysteresis | Displays the actual setting of the sensitivity (Normal or Reduced). |
| | | Synchronization | Displays the actual setting of the synchronization function (Normal, Sync at 0%, Sync at 100%). |
| | **Data Log** | Total Time / Operating Time | Total number of hours the actuator is connected to a power supply. |
| | | Active Time | Total number of hours the actuator is in motion. |
| | | Stop / Go Ratio (Hunting %) | Displays a percentage the total number of hours the actuator has spent in mechanical motion, comparing the total time to the active time. |
| | **Sensitivity** | Normal, Reduced | Displays the setting of the sensitivity function. |
| Functions | **Messages** | | Displays all messages present. Messages can be deleted as well. |
| | **Function Test** | | This function enables you to check for complete opening and closing of the actuator.<br>The test report contains:<br>• Information on the Project<br>• Identification on the Actuator<br>• A list of fault messages pending before the start of the test<br>• The test steps and results<br>• The current actuator settings<br>This is of benefit when troubleshooting an application, as the actuator will drive the damper or valve. This gives an opportunity to observe the installation to identify any possible problems. |
| | **Adaptation** | **See Adaptation on page 13.** | Initiates the adaptation feature of the MFT actuator. The actuators working range (input, feedback, and running time) will be adapted to the actual angle of rotation.<br>This is of benefit when troubleshooting an application, as the actuator will drive the damper or valve. This gives you an opportunity to observe the installation to identify any possible problems. |
| | **Synchronization** | Normal | At initial commissioning, when the manual override button is pressed, the actuator runs to a default position defined by the position of the CW/CCW direction of rotation switch. |
| | | Sync at 0% | At each power-up (includes power failures), the actuator runs to a default position defined by the position of the CW/CCW direction of rotation switch. |
| | | Sync at 100% | At each power-up (includes power failures), the actuator runs to a default position of the CW/CCW direction of rotation switch. |

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***WARNING*** The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

***Always read the controller manufacturer's installation literature carefully before making any connections.*** Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

## Transformer(s)

Non-spring return actuators require a 24 VAC class 2 transformer and draws a maximum of 5 VA per actuator. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

– EMC directive: 89/336/EEC
– Software class A: Mode of operation type 1
– Low voltage directive: 73/23/EEC

***CAUTION***: It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

**Typical Transformer Sizing**

| Actuator Series | Voltage | Required VA Per Actuator |
|---|---|---|
| **AF** | 24 | 10 |
| **NF** | 24 | 6 |
| **LF** | 24 | 6 |
| **TF** | 24 | 4 |
| **GMB/GRB** | 24 | 7 |
| **AMB/ARB** | 24 | 6 |
| **NMB** | 24 | 6 |
| **LMB/LRB** | 24 | 5 |
| **AHB** | 24 | 6 |
| **LHB** | 24 | 5 |
| **LUB** | 24 | 5 |
| **AMQB** | 24 | 18 |
| **NMQB** | 24 | 18 |
| **LMQB** | 24 | 18 |
| **AHQB** | 24 | 18 |
| **LHQB** | 24 | 18 |

## Multiple Actuators, One Transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. *This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg.* Switching wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

## Multiple Actuators, Multiple Transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram on page 11.

## Wire Lengths for Actuators

Keep power wire runs below the lengths listed in the **Figure H.** If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Example: 3 actuators, 16 Ga wire
350 Ft ÷ 3 Actuators = 117 Ft. Maximum wire run

**LH-24…/LU-24…**

| Wire Size | Max. Feet. |
|---|---|
| 16 Ga | 1175 Ft. |
| 18 Ga | 1075 Ft. |
| 20 Ga | 575 Ft. |
| 22 Ga | 300 Ft. |

**LM-24…/CM24**

| Wire Size | Max. Feet |
|---|---|
| 16 Ga | 1125 Ft. |
| 18 Ga | 750 Ft. |
| 20 Ga | 400 Ft. |
| 22 Ga | 200 Ft. |

**NM-24…/AH-24…/LMX120…**

| Wire Size | Max. Feet. |
|---|---|
| 12 Ga | 1250 Ft. |
| 14 Ga | 1130 Ft. |
| 16 Ga | 900 Ft. |
| 18 Ga | 575 Ft. |
| 20 Ga | 300 Ft. |
| 22 Ga | 150 Ft. |

**AM-24…**

| Wire Size | Max. Feet |
|---|---|
| 12 Ga | 1150 Ft. |
| 12 Ga | 925 Ft. |
| 16 Ga | 550 Ft. |
| 18 Ga | 375 Ft. |
| 20 Ga | 200 Ft. |
| 22 Ga | 100 Ft. |

**GM…/NMX120…/AMX120…**

| Wire Size | Max. Feet. | Wire Size | Max. Feet |
|---|---|---|---|
| 12 Ga | 1125 Ft. | 18 Ga | 325 Ft. |
| 14 Ga | 800 Ft. | 20 Ga | 175 Ft. |
| 16 Ga | 500 Ft. | 22 Ga | 90 Ft. |

**FIGURE H – Maximum Wire Lengths**

## Wire Type and Wire Installation Tips

For most installations, 18 or 16 Ga. cable works well with the non-spring return actuators. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

The non-spring return proportional actuators have a digital circuit that is designed to ignore most unwanted input signals (pickup). In some situations the pickup may be severe enough to cause erratic running of the actuator. For example, a large inductive load (high voltage AC wires, motors, etc.) running near the power or control wiring may cause excessive pickup. To solve this problem, make one or more of the following changes:

1. Run the wire in metallic conduit.
2. Re-route the wiring away from the source of pickup.
3. Use shielded wire (Belden 8760 or equal). Ground the shield to an earth ground. Do not connect it to the actuator common.

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### *ATTENTION*

**Master-Slave is the correct method for wiring multiple Belimo MFT actuators to a single load. For example, you can have up to four AF24-MFT US on a single damper jackshaft or two GMX24-MFT on a large butterfly valve.**

The current Belimo solution is to mount multiple actuators onto the damper or valve. In the past this required the installer to wire the actuators in a "master-slave" arrangement. This was typical for the AF24-SR US actuator.

By adding more actuators you can effectively increase the torque proportional to the minimum specified torque times the number of actuators. This is normal as seen on the following installations.

- **Large dampers or valves**
- **Large multiple section dampers**
- **Rack and Pinion style globe valves**
- **Ball or Butterfly valves**

For retrofit of an existing AF24-SR US which is wired in "Master-Slave", rewire the installation so the remaining AF24-SR US is now the "Master" and the new AF24-MFT US is the "Slave".

**Multiple actuators mounted to one control shaft**

| Model | Max. Qty Per Shaft | Torque Generated |
|---|---|---|
| AF24-MFT(-S) US | 4 | 532 in-lb |
| NF24-MFT(-S) US | 1 | 60 in-lb |
| LF24-MFT(-S) US | 1 | 35 in-lb |
| GMX24-MFT | 2 | 640 in-lb |
| AMX24-MFT | 1 | 180 in-lb |
| NMX24-MFT | 1 | 90 in-lb |
| LMX24-MFT | 1 | 45 in-lb |

The wiring method for multiple actuators mounted to shafts which are **not** mechanically connecting other actuators is to wire the control signal in parallel with each actuator.

**Multiple XM24-MFT95…**

EXCEPTION No mechanical dual mounting of AF24-MFT95 US is possible. Electrical parallel wiring of AF24-MFT95 US is possible only for mechanically separate applications.

SOLUTION For increased torque requirement use AF24-MFT95 US as a master and the slave must be an AF24-MFT US. The masters feedback must match the slaves input signal. (Both are default 2-10 VDC.)

## Wiring Diagrams

### *INSTALLATION NOTES*

1 Provide overload protection and disconnect as required.

2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.

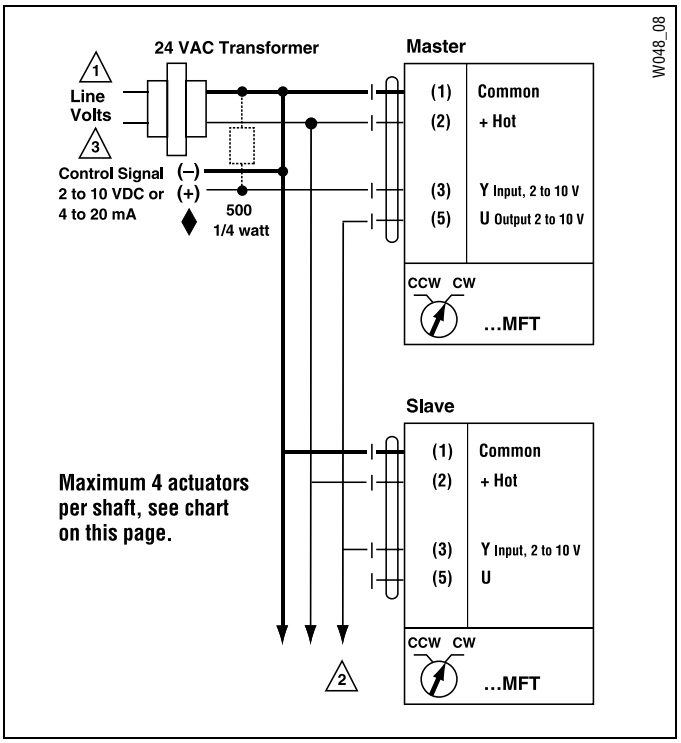
3 Actuators may also be powered by 24 VDC.

5 Control signal may be pulsed from either the Hot (source) or the Common (sink) 24 VAC line.

### *APPLICATION NOTES*

♦ The ZG-R01 500 Ω resistor may be used.

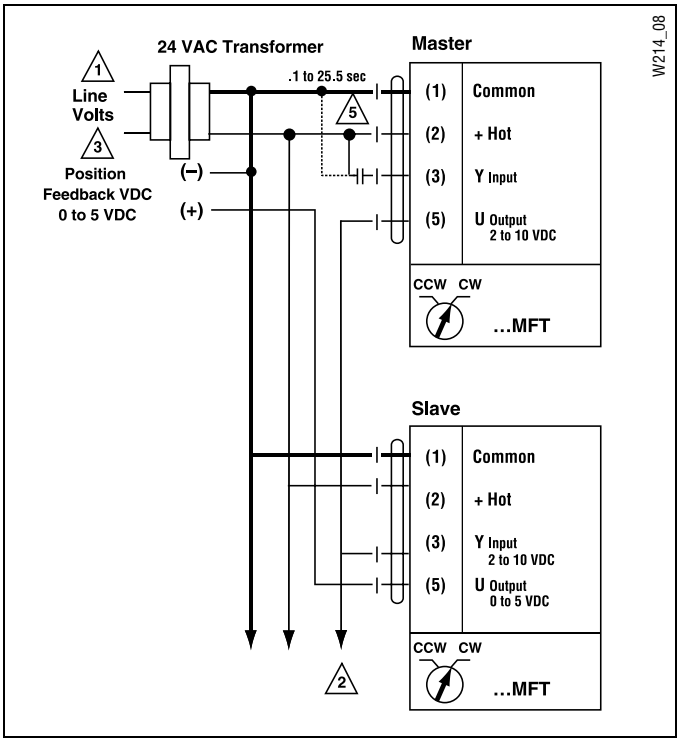
***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.




**Wiring multiple …MFT actuators to one shaft.**
**All MFT actuators are wired in master-slave configuration.**

**Wiring of multiple …MFT actuators on valves must be master-slave (wires 3-5).**

**MFT actuator configurations should also co-ordinate with each other. Meaning the master input = controllers output. Master output = slave input. Slave output = controller input.**




| Controller Output | Master Feedback | Slave Input | Slave Feedback |
|---|---|---|---|
| 0.1 to 25.5 sec | 2 to 10 VDC | 2 to 10 VDC | 0 to 5 VDC |

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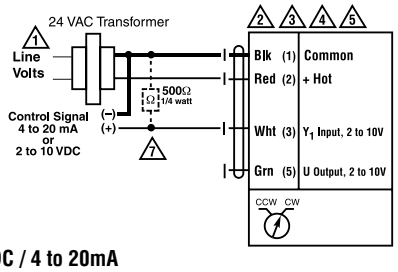
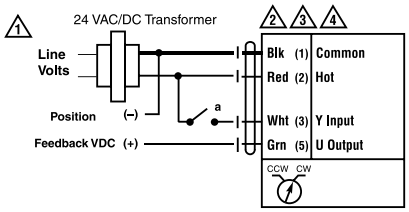
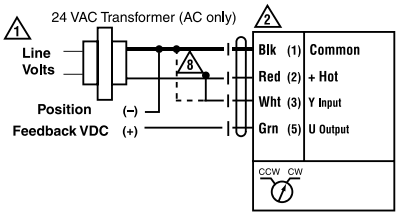
## Spring Return Actuator with MFT


24 VAC Transformer
Line Volts
500Ω 1/4 watt
Control Signal 4 to 20 mA or 2 to 10 VDC
Blk (1) Common
Red (2) + Hot
Wht (3) Y1 Input, 2 to 10V
Grn (5) U Output, 2 to 10V
CCW CW

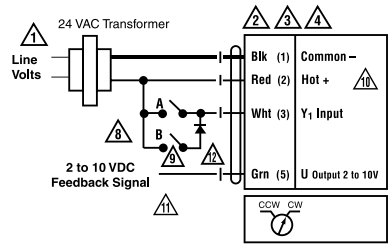
**VDC / 4 to 20mA**



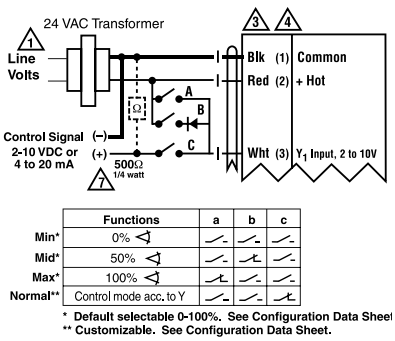

**Two Position**




**PWM**




**Floating Point**




| Functions | a | b | c |
|---|---|---|---|
| Min* 0% | | | |
| Mid* 50% | | | |
| Max* 100% | | | |
| Normal** Control mode acc. to Y | | | |

* Default selectable 0-100%. See Configuration Data Sheet
** Customizable. See Configuration Data Sheet.

**Override control to min, mid, max positions**

1. Provide overload protection and disconnect as required.
2. Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
3. Actuators may also be powered by 24 VDC.
4. Meets cULus requirements without the need of an electrical ground connection.
5. Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
7. A 500Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.
8. Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.
9. Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
10. For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller.
11. Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.
12. IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155)

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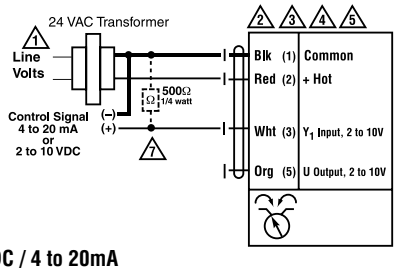
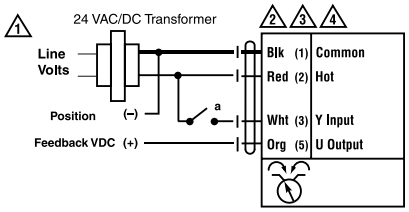
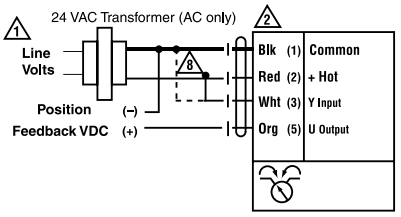
## Non-Spring Return Actuator with MFT


24 VAC Transformer
Line Volts
500Ω 1/4 watt
Control Signal 4 to 20 mA or 2 to 10 VDC
Blk (1) Common
Red (2) + Hot
Wht (3) Y1 Input, 2 to 10V
Org (5) U Output, 2 to 10V

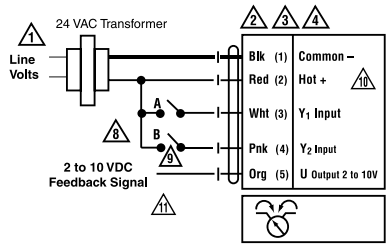
**VDC / 4 to 20mA**



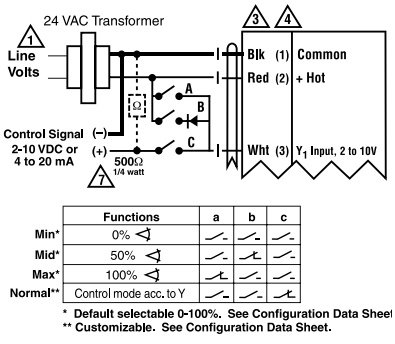

**Two Position**




**PWM**


24 VAC Transformer
Line Volts
2 to 10 VDC Feedback Signal
Blk (1) Common –
Red (2) Hot +
Wht (3) Y1 Input
Pnk (4) Y2 Input
Org (5) U Output 2 to 10V

**Floating Point**




| Functions | a | b | c |
|---|---|---|---|
| Min* 0% | | | |
| Mid* 50% | | | |
| Max* 100% | | | |
| Normal** Control mode acc. to Y | | | |

* Default selectable 0-100%. See Configuration Data Sheet
** Customizable. See Configuration Data Sheet.

**Override control to min, mid, max positions**

1. Provide overload protection and disconnect as required.
2. Actuators may be connected in parallel if not mechanically mounted to the same shaft. Power consumption and input impedance must be observed.
3. Actuators may also be powered by 24 VDC.
4. Meets cULus requirements without the need of an electrical ground connection.
5. Actuators with plenum rated cable do not have numbers on wires; use color codes instead. Actuators with appliance cables are numbered.
7. A 500Ω resistor converts the 4 to 20 mA control signal to 2 to 10 VDC.
8. Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 VAC line.
9. Contact closures A & B also can be triacs. A & B should both be closed for triac source and open for triac sink.
10. For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller.
11. Position feedback cannot be used with a Triac sink controller. The actuator internal common reference is not compatible.

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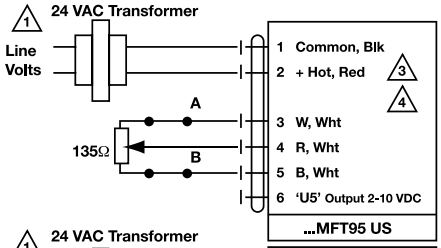
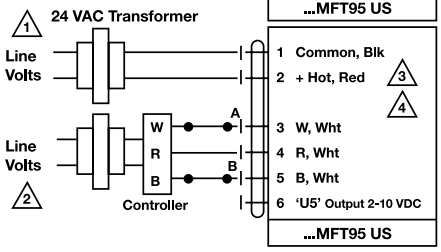
## 0 to 135 Ω Control (MFT95)

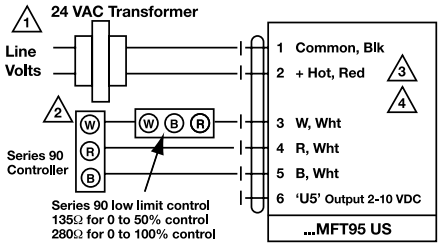
| Switch A | Switch B | Damper Position |
|---|---|---|
| | | Damper Open |
| | | Damper Closed |

The direction of rotation switch is set so that the fail safe position and the position of the damper is closed with no signal at wire R.

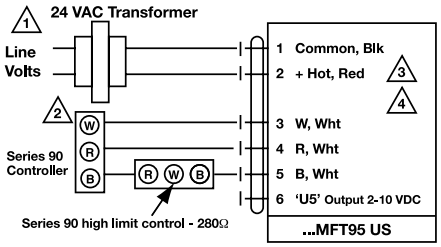


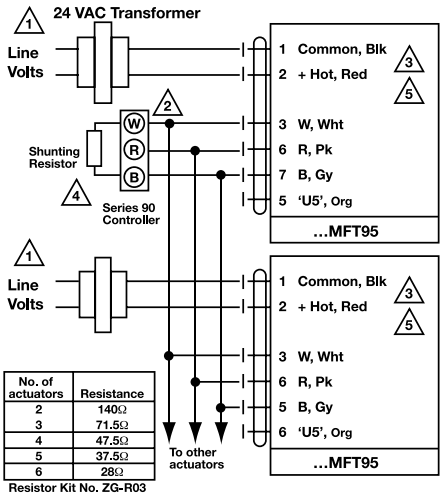

### Override



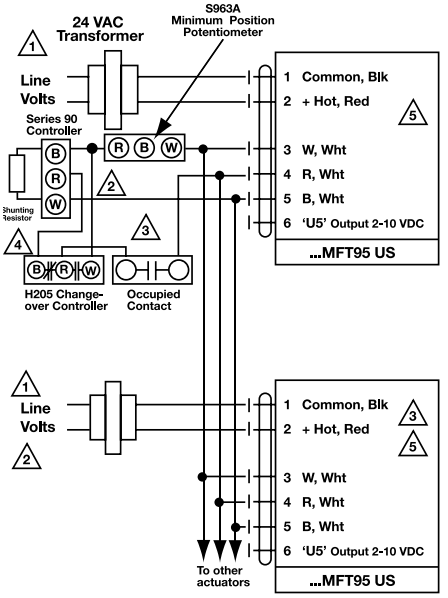

### Low Limit Control



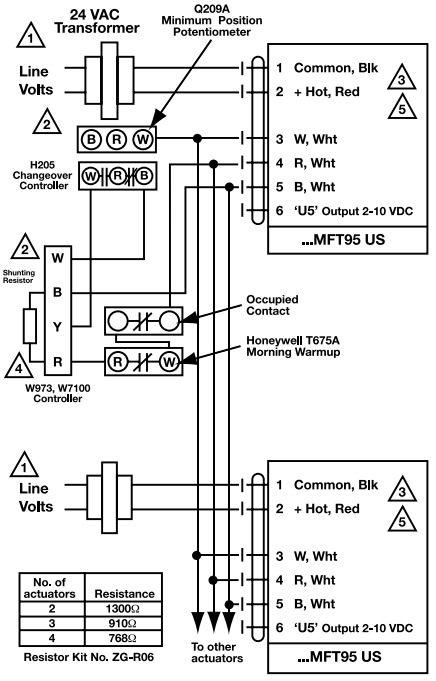

### High Limit Control



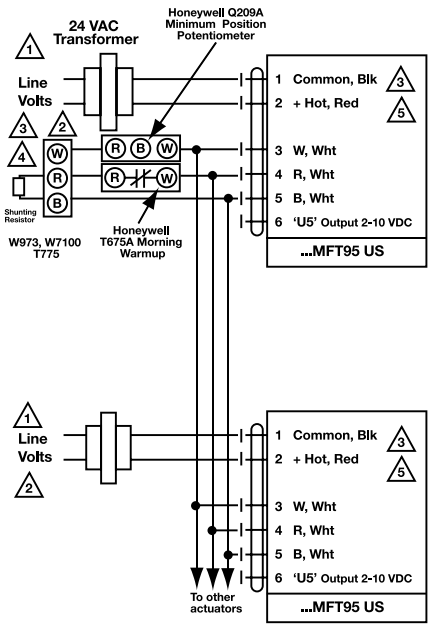

### Wiring multiple actuators to a Series 90 controller




### Wiring multiple actuators to a Series 90 controller using a minimum position potentiometer




### Used with the W973 and W7100 controllers.




### Typical wiring diagrams for multiple actuators used with the W973, W7100 and T775 controllers.

1. Provide overload protection and disconnect as required.
2. Actuators and controller must have separate transformers.
3. Consult controller instruction data for more detailed installation information.
4. Resistor value depends on the type of controller and the number of actuators. No resistor is used for one actuator. Honeywell resistor kits may also be used.
5. To reverse control rotation, use the reversing switch.

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **A01** | 150s | 2...10V | U5 | U5 2...10V | P-10001 | NO | manual |
| **A02** | 150s | 0.5...10V | U5 | U5 0.5…10V | P-10002 | NO | manual |
| **A03** | 150s | 2...10V | U5 | U5 0.5…5V | P-10003 | NO | manual |
| **A04** | 150s | 4...7V | U5 | U5 2…10V | P-10004 | NO | manual |
| **A05** | 150s | 6...9V | U5 | U5 2…10V | P-10005 | NO | manual |
| **A06** | 150s | 10.5...13.5V | U5 | U5 2…10V | P-10006 | NO | manual |
| **A07** | 150s | 0.5...5V | U5 | U5 2…10V | P-10007 | NO | manual |
| **A08** | 150s | 0.5...5V | U5 | U5 0.5…10V | P-10008 | NO | manual |
| **A09** | 150s | 5...10V | U5 | U5 2…10V | P-10009 | NO | manual |
| **A10** | 150s | 5...10V | U5 | U5 0.5…10V | P-10010 | NO | manual |
| **A11** | 150s | 0.5...5V | U5 | U5 0.5…5V | P-10011 | NO | manual |
| **A12** | 150s | 0.5...5V | U5 | U5 0.5…2.5V | P-10012 | NO | manual |
| **A13** | 150s | 0.5...10V | U5 | U5 2…10V | P-10013 | NO | manual |
| **A14** | 100s | 0.5…10V | U5 | U5 0.5…2.5V | P-10014 | NO | manual |
| **A15** | 150s | 2…5V | U5 | U5 2…10V | P-10015 | NO | manual |
| **A16** | 150s | 2…6V | U5 | U5 2…10V | P-10016 | NO | manual |
| **A17** | 150s | 6…10V | U5 | U5 2…10V | P-10017 | NO | manual |
| **A18** | 150s | 14…17V | U5 | U5 2…10V | P-10018 | NO | manual |
| **A19** | 100s | 2...10V | U5 | U5 2...10V | P-10019 | NO | manual |
| **A20** | 150s | 9...12V | U5 | U5 2...10V | P-10020 | NO | manual |
| **A21** | 150s | 2…10V | U5 | U5 0.5…5V | P-10021 | NO | manual |
| **A22** | 150s | 0.5…4.9V | U5 | 0.5…4.9V | P-10022 | NO | manual |
| **A23** | 150s | 5.1…10V | U5 | 5.1…10V | P-10023 | NO | manual |
| **A24** | 150s | 0.5…24V | U5 | U5 2...10V | P-10024 | NO | manual |
| **A25** | 76s | 2...10V | U5 | U5 2...10V | P-10025 | NO | manual |
| **A26** | 150s | 2…9V | U5 | U5 2...10V | P-10026 | NO | manual |
| **A27** | 150s | 5…9V | U5 | U5 2...10V | P-10027 | NO | manual |
| **A28** | 100s | 0.5...10V | U5 | U5 0.5…10V | P-10028 | NO | manual |
| **A29** | 150s | 1…3V | U5 | U5 2...10V | P-10029 | NO | manual |
| **A30** | 150s | 3…9V | U5 | U5 2...10V | P-10030 | NO | manual |
| **A31** | 150s | 0.5…4V | U5 | U5 2...10V | P-10031 | NO | manual |
| **A32** | 150s | 6…14V | U5 | U5 2...10V | P-10032 | NO | manual |
| **A33** | 150s | 4…14V | U5 | U5 2...10V | P-10033 | NO | manual |
| **A34** | 120s | 2...10V | U5 | U5 2...10V | P-10034 | NO | manual |
| **A35** | 78s | 2...10V | U5 | U5 2...10V | P-10035 | NO | manual |
| **A37** | 120s | 0.5...10V | U5 | U5 0.5…10V | P-10037 | NO | manual |
| **A38** | 150s | 6...13V | U5 | U5 2...10V | P-10038 | NO | manual |
| **A39** | 150s | 10...14V | U5 | U5 2...10V | P-10039 | NO | manual |
| **A40** | 150s | 1...16V | U5 | U5 2...10V | P-10040 | NO | manual |
| **A41** | 150s | 3...6V | U5 | U5 2...10V | P-10041 | NO | manual |
| **A42** | 75s | 0.5…10V | U5 | U5 2...10V | P-10042 | NO | manual |
| **A43** | 150s | 0.5…2.5V | U5 | U5 2...10V | P-10043 | NO | manual |
| **A44** | 150s | 7…10V | U5 | U5 2...10V | P-10044 | NO | manual |
| **A45** | 150s | 13...17V | U5 | U5 2...10V | P-10045 | NO | manual |
| **A46** | 150s | 2...10V | U5 | U5 2...10V | P-10046 | NO | manual |
| **A47** | 150s | 0.5…20V | U5 | U5 2...10V | P-10047 | NO | manual |
| **A48** | 150s | 1…5V | U5 | U5 1…5V | P-10048 | NO | auto-adapt. |
| **A49** | 150s | 1…5V | U5 | U5 1…5V | P-10049 | NO | auto-adapt. |
| **A51** | | | | | P-10051 | | |
| **A52** | 150s | 2...10V | U5 | U5 0.5…5V | P-10052 | NO | manual |
| **A53** | 120s | 0.5…10V | U5 | U5 2...10V | P-10053 | NO | manual |
| **A54** | 150s | 0.5…2.5V | U5 | U5 0.5…2.5V | P-10054 | NO | manual |
| **A55** | 75s | 2…5V | U5 | U5 2...10V | P-10055 | NO | manual |
| **A56** | 75s | 6…9V | U5 | U5 2...10V | P-10056 | NO | manual |
| **A57** | 150s | 2…5.5V | U5 | U5 2...10V | P-10057 | NO | manual |
| **A58** | 150s | 6.5…10V | U5 | U5 2...10V | P-10058 | NO | manual |
| **A59** | 150s | 0.5…6V | U5 | U5 2...10V | P-10059 | NO | manual |
| **A60** | 300s | 2…10V | U5 | U5 2...10V | P-10060 | NO | manual |
| **A61** | 150s | 10…20V | U5 | U5 2...10V | P-10061 | NO | manual |
| **A62** | 90s | 2…10V | U5 | U5 2...10V | P-10062 | NO | manual |
| **A63** | 150s | 0.5…4.5V | U5 | U5 0.5…4.5V | P-10063 | NO | manual |
| **A64** | 150s | 5.5…10V | U5 | U5 5.5…10V | P-10064 | NO | manual |
| **A65** | 150s | 1…5V | U5 | U5 1…5V | P-10065 | NO | manual |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **A66** | 150s | 2…10V | U5 | U5 1…5V | P-10066 | NO | manual |
| **A67** | 150s | 2…8V | U5 | U5 2…10V | P-10067 | NO | manual |
| **A68** | 150s | 2…13V | U5 | U5 2…10V | P-10068 | NO | manual |
| **A69** | 150s | 1..4V | U5 | U5 2…10V | P-10069 | NO | manual |
| **A70** | 150s | 3.5…10V | U5 | U5 2…10V | P-10070 | NO | manual |
| **A71** | 150s | 2…15V | U5 | U5 2…10V | P-10071 | NO | manual |
| **A72** | 95s | 2…10V | U5 | U5 2…10V | P-10072 | NO | manual |
| **A73** | 150s | 6…18V | U5 | U5 2…10V | P-10073 | NO | manual |
| **A74** | 150s | 2…10V | U5 | U5 2…10V | P-10074 | NO | manual |
| **A76** | 150s | 0.5…3V | U5 | U5 0.5…10V | P-10076 | NO | manual |
| **A77** | 76s | 0.5…10V | U5 | U5 0.5…10V | P-10077 | NO | manual |
| **A78** | 150s | 2…10V | U5 | U5 0.5…10V | P-10078 | NO | manual |
| **A79** | 150s | 0.5…10V | U5 | U5 0.5…5V | P-10079 | NO | manual |
| **A80** | 150s | 0.5…3.5 | U5 | U5 2…10V | P-10080 | NO | manual |
| **A81** | 150s | 4.5…10 | U5 | U5 2…10V | P-10081 | NO | manual |
| **A82** | 150s | 3…10V | U5 | U5 2…10V | P-10082 | NO | manual |
| **A83** | 150s | 5…15V | U5 | U5 2…10V | P-10083 | NO | manual |
| **A84** | 150s | 13…20V | U5 | U5 2…10V | P-10084 | NO | manual |
| **A85** | 150s | 2…10V | U5 | U5 2…10V | P-10085 | NO | manual |
| **A86** | 150s | 5…10.5 | | U5 2…10V | P-10086 | NO | manual |
| **A88** | 150s | 2…10V | U5 | U5 2…10V | P-10088 | NO | manual |
| **A89** | 150s | 12.5…22V | U5 | U5 2…10V | P-10089 | NO | manual |
| **A90** | 150s | 2…5V | U5 | U5 2…5V | P-10090 | NO | manual |
| **A91** | 95s | 2…10V | U5 | U5 2…10V | P-10091 | NO | manual |
| **A92** | 150s | 0.5…15V | U5 | U5 0.5…10V | P-10092 | NO | manual |
| **A93** | 150s | 2…10V | U5 | U5 2…10V | P-10093 | NO | manual |
| **A94** | 85s | 2…10V | U5 | U5 2…10V | P-10094 | NO | manual |
| **A95** | 150s | 0.5…5V | U5 | U5 0.5…5V | P-10095 | NO | manual |
| **A96** | 150s | 0.5…10V | U5 | U5 2…10V | P-10096 | NO | manual |
| **A97** | 150s | 5.25…7.25 | U5 | U5 2…10V | P-10097 | NO | manual |
| **A98** | 150s | 2…10V | U5 | U5 2…10V | P-10098 | NO | auto-synch. |
| **A99** | 150s | 2…10V | U5 | U5 2…10V | P-10099 | NO | manual |
| **AA0** | 150s | 0.5…12.85 | U5 | U5 2…10V | P-10100 | NO | manual |
| **AA1** | 150s | 3…15V | U5 | U5 2…10V | P-10101 | NO | manual |
| **AA2** | 150s | 0.5…14V | U5 | U5 2…10V | P-10102 | NO | manual |
| **AA4** | 150s | 0.5…22V | U5 | U5 2…10V | P-10104 | NO | manual |
| **AA5** | 150s | 0.5…4V | U5 | U5 0.5…5V | P-10105 | NO | manual |
| **AA6** | 150s | 6…10V | U5 | U5 0.5…5V | P-10106 | NO | manual |
| **AA7** | 150s | 2…7V | U5 | U5 2…10V | P-10107 | NO | manual |
| **AA8** | 150s | 4…10V | U5 | U5 2…10V | P-10108 | NO | manual |
| **AA9** | | | | | P-10109 | | |
| **AAA** | 150s | 2…22V | U5 | U5 2…10V | P-10110 | NO | manual |
| **AAB** | 150s | 0.5…20V | U5 | U5 0.5…10V | P-10111 | NO | manual |
| **AAC** | 150s | 0.5….29V | U5 | U5 2…10V | P-10112 | NO | manual |
| **AAD** | 100s | 0.5…4.5V | U5 | U5 0.5…4.5V | P-10113 | NO | manual |
| **AAE** | 100s | 5.5…10V | U5 | U5 5.5…10V | P-10114 | NO | manual |
| **AAF** | 150s | 0.5…28V | U5 | U5 2…10V | P-10115 | NO | manual |
| **AAG** | 75s | 0.5…10V | U5 | U5 2…10V | P-10116 | NO | auto-adapt. |
| **AAH** | 150s | 0.5…10V | U5 | U5 4…5V | P-10117 | NO | auto-adapt. |
| **AAJ** | 100s | 2…6V | U5 | U5 2…10V | P-10118 | NO | auto-adapt. |
| **AAK** | 100s | 6…10V | U5 | U5 2…10V | P-10119 | NO | manual |
| **AAL** | 150s | 8…20V | U5 | U5 2…10V | P-10120 | NO | manual |
| **AAM** | 120s | 0.5…10V | U5 | U5 2…10V | P-10121 | NO | auto-synch. |
| **AAN** | 100s | 0.5…10V | U5 | U5 2…10V | P-10122 | NO | manual |
| **AAP** | 150s | 2…10V | U5 | U5 2…10V | P-10123 | NO | manual |
| **AAR** | 150s | 2…10V | U5 | U5 2…10V | P-10124 | NO | auto-adapt. |
| **AAS** | 150s | 2…10V | U5 | U5 2…10V | P-10125 | NO | manual |
| **AAT** | 20s | 2…10V | U5 | U5 2…10V | --- | NO | manual |
| **AAU** | 100s | 6…9V | U5 | U5 2…10V | --- | NO | manual |
| **AAV** | 150s | 1.2…6V | U5 | U5 2…10V | --- | NO | manual |
| **AAW** | | | | | | | |
| **AAX** | 35s | 2…10V | U5 | U5 2...10V | P-10130 | NO | manual |
| **AC0** | 45s | 2…10V | U5 | U5 2...10V | P-10131 | NO | manual |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **AC1** | 90s | 2…10V | U5 | U5 2...10V | P-10132 | NO | manual |
| **AC2** | 150s | 0.5…10V | U5 | U5 0.5…10V | --- | NO | manual |
| **000** | 150s | 2…10V | U5 | U5 2...10V | --- | YES | manual |
| **AC4** | 150s | 0.5…10V | U5 | U5 0.5…10V | --- | YES | manual |
| **AC5** | 75s | 2…10V | U5 | U5 2…10V | P-10133 | NO | manual |
| **AC6** | 450s | 2…10V | U5 | U5 2…10V | P-10134 | NO | manual |
| **AC7** | 150s | … | U5 | U5 2...10V | --- | NO | manual |
| **AC8** | 35s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **AC9** | 45s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **ACA** | 90s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **ACC** | stop | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **ACD** | stop | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **ACE** | stop | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **ACF** | stop | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **ACG** | | | | | | | |
| **ACH** | stop | 4…20mA | U5 | U5 2...10V | --- | NO | manual |
| **ACJ** | open | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **ACK** | open | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **ACL** | | | | | | | |
| **ACM** | open | 4…20mA | U5 | U5 2...10V | --- | NO | manual |
| **ACN** | close | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **ACP** | close | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **ACR** | | | | | | | |
| **ACS** | close | 4…20mA | U5 | U5 2...10V | --- | NO | manual |
| **ACT** | --- | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **ACU** | --- | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **ACV** | | | | | | | |
| **ACW** | --- | 4…20mA | U5 | U5 2...10V | --- | NO | manual |
| **ACX** | 150s | 2...10V | U5 | U5 0.5...10V | | NO | manual |
| **AD0** | 100s | 0.5...5V | U5 | U5 2...10V | P-10135 | NO | manual |
| **AD1** | 100s | 5…10V | U5 | U5 2...10V | P-10136 | NO | manual |
| **AD2** | 90s | 2…10V | U5 | U5 2...10V | --- | NO | auto-adapt. |
| **AD3** | 35s | 2…10V | U5 | U5 2...10V | --- | NO | auto-adapt. |
| **AD4** | 150s | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **AD5** | 100s | 2...5V | U5 | U5 2...10V | P-10137 | NO | manual |
| **AD6** | | | | | | | |
| **AD7** | 100s | 0.5...5V | U5 | U5 2...10V | P-10140 | NO | manual |
| **AD8** | | | | | | | |
| **AD9** | | | | | | | |
| **ADA** | 100s | 0.5...10V | U5 | U5 0.5…10V | --- | NO | manual |
| **ADC** | | | | | | | |
| **ADD** | 150s | 9…13V | U5 | U5 2...10V | --- | NO | manual |
| **ADE** | | | | | | | |
| **ADF** | | | | | | | |
| **ADG** | | | | | | | |
| **ADH** | | | | | | | |
| **ADJ** | | | | | | | |
| **ADK** | | | | | | | |
| **ADL** | | | | | | | |
| **ADM** | | | | | | | |
| **ADN** | | | | | | | |
| **ADP** | | | | | | | |
| **ADR** | | | | | | | |
| **ADS** | | | | | | | |
| **ADT** | | | | | | | |
| **ADU** | | | | | | | |
| **ADV** | | | | | | | |
| **ADW** | | | | | | | |
| **ADX** | | | | | | | |
| **AE0** | | | | | | | |
| **AE1** | | | | | | | |
| **AE2** | | | | | | | |
| **AE3** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **AE4** | | | | | | | |
| **AE5** | | | | | | | |
| **AE6** | | | | | | | |
| **AE7** | | | | | | | |
| **AE8** | | | | | | | |
| **AE9** | | | | | | | |
| **AEA** | 120s | 0.5…10V | U5 | U5 0.5…10V | --- | NO | manual |
| **AEC** | 75s | 0.5…10V | U5 | U5 0.5…10V | --- | NO | manual |
| **AED** | 300s | 0.5…10V | U5 | U5 0.5…10V | --- | NO | manual |
| **AEE** | 450s | 0.5…10V | U5 | U5 0.5…10V | --- | NO | manual |
| **AEF** | | | | | | | |
| **AEG** | | | | | | | |
| **AEH** | | | | | | | |
| **AEJ** | | | | | | | |
| **AEK** | | | | | | | |
| **AEL** | | | | | | | |
| **AEM** | | | | | | | |
| **AEN** | | | | | | | |
| **AEP** | | | | | | | |
| **AER** | | | | | | | |
| **AES** | | | | | | | |
| **AET** | | | | | | | |
| **AEU** | | | | | | | |
| **AEV** | | | | | | | |
| **AEW** | | | | | | | |
| **AEX** | | | | | | | |
| **AF0** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **R01** | 150s | 0…135 Ohm | U5 | U5 2…10V | P-16001 | NO | manual |
| **R02** | 150s | 0…135 Ohm | U5 | U5 0.5…10V | P-16002 | NO | manual |
| **R03** | 150s | 0…135 Ohm | U5 | U5 0.5…5V | P-16003 | NO | manual |
| **R04** | 75s | 0…135 Ohm | U5 | U5 2…10V | P-16004 | NO | manual |
| **R05** | 100s | 0…135 Ohm | U5 | U5 0.5…10V | P-16028 | NO | manual |
| **R06** | | | | | P-16029 | | |
| **R07** | 35s | 0…135 Ohm | U5 | U5 2…10V | | NO | manual |
| **R08** | 45s | 0…135 Ohm | U5 | U5 2…10V | | NO | manual |
| **R09** | 90s | 0…135 Ohm | U5 | U5 2…10V | | NO | manual |
| **R0A** | 37s | 0…135 Ohm | U5 | U5 2…10V | | NO | manual |
| **R0C** | | | | | | | |
| **R0D** | | | | | | | |
| **R0E** | | | | | | | |
| **R0F** | | | | | | | |
| **R0G** | | | | | | | |
| **R0H** | | | | | | | |
| **R0J** | | | | | | | |
| **R0K** | | | | | | | |
| **R0L** | | | | | | | |
| **R0M** | | | | | | | |
| **R0N** | | | | | | | |
| **R0P** | | | | | | | |
| **R0R** | | | | | | | |
| **R0S** | | | | | | | |
| **R0T** | | | | | | | |
| **R0U** | | | | | | | |
| **R0V** | | | | | | | |
| **R0W** | | | | | | | |
| **R0X** | | | | | | | |
| **R10** | | | | | | | |
| **R11** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **W01** | 150s | 0.59…2.93s | U5 | U5 2…10V | P-20001 | NO | manual |
| **W02** | 150s | 0.02…5s | U5 | U5 2…10V | P-20002 | NO | manual |
| **W03** | 150s | 0.1…25.5s | U5 | U5 2…10V | P-20003 | NO | manual |
| **W04** | 150s | 0.1…25.6s | U5 | U5 2…10V | P-20004 | NO | manual |
| **W05** | 150s | 0.1…5.2s | U5 | U5 0.5…5V | P-20005 | NO | manual |
| **W06** | 150s | 0.59…2.93s | U5 | U5 0.5…10V | P-20006 | NO | manual |
| **W07** | 150s | 0.02…5s | U5 | U5 0.5…5V | P-20007 | NO | manual |
| **W08** | 150s | 0.1…10s | U5 | U5 2…10V | P-20008 | NO | manual |
| **W09** | 150s | 1…11s | U5 | U5 2…10V | P-20009 | NO | manual |
| **W10** | 150s | 0.02…5s | U5 | U5 2…10V | P-20010 | NO | manual |
| **W11** | 150s | 0.02…5.6s | U5 | U5 2…10V | P-20011 | NO | manual |
| **W12** | 150s | 0.5…25.5s | U5 | U5 2…10V | P-20012 | NO | manual |
| **W13** | 150s | 0.5…2.93s | U5 | U5 2…10V | P-20013 | NO | manual |
| **W14** | 150s | 0.1…10s | U5 | U5 2…10V | P-20014 | NO | manual |
| **W15** | 150s | 1…11s | U5 | U5 2…10V | P-20015 | NO | manual |
| **W16** | 150s | 0.02…5s | U5 | U5 2…10V | P-20016 | NO | auto-adapt. |
| **W17** | 150s | 0.02…5.6s | U5 | U5 2…10V | P-20017 | NO | auto-adapt. |
| **W18** | 150s | 0.1…25.5s | U5 | U5 2…10V | P-20018 | NO | auto-adapt. |
| **W19** | 150s | 0.02…2.5s | U5 | U5 2…10V | P-20019 | NO | manual |
| **W20** | 150s | 2.7…5s | U5 | U5 2…10V | P-20020 | NO | manual |
| **W21** | 150s | 0.1…5.2s | U5 | U5 2…10V | P-20021 | NO | manual |
| **W22** | 150s | 0.1…12.85s | U5 | U5 2…10V | P-20022 | NO | manual |
| **W23** | 150s | 5.1…10.1s | U5 | U5 2…10V | P-20023 | NO | manual |
| **W24** | 150s | 0.59…1.76s | U5 | U5 2…10V | P-20024 | NO | manual |
| **W25** | 150s | 1.76…2.93s | U5 | U5 2…10V | P-20025 | NO | manual |
| **W26** | 150s | 0.02…12s | U5 | U5 2…10V | P-20026 | NO | manual |
| **W27** | 150s | 0.02…14s | U5 | U5 2…10V | P-20027 | NO | manual |
| **W28** | 150s | 12.5…22s | U5 | U5 2…10V | P-20028 | NO | manual |
| **W29** | 150s | 0.5…12.85s | U5 | U5 2…10V | P-20029 | NO | manual |
| **W30** | 150s | 0.1…24s | U5 | U5 2…10V | P-20030 | NO | manual |
| **W31** | 100s | 0.02…5s | U5 | U5 2…10V | P-20031 | NO | off |
| **W32** | 100s | 0.1…25.5 | U5 | U5 2…10V | P-20032 | NO | off |
| **W33** | 150s | 0.2…25.5 | U5 | U5 2…10V | P-20033 | NO | manual |
| **W34** | 100s | 0.59…2.93s | U5 | U5 2…10V | P-20034 | NO | off |
| **W35** | 150s | 5.5…9.5s | U5 | U5 2…10V | P-20035 | NO | manual |
| **W36** | 150s | 0.5…4.5s | U5 | U5 2…10V | P-20036 | NO | manual |
| **W37** | 150s | 0.1…5.2s | U5 | U5 0.5…10V | P-20037 | NO | manual |
| **W38** | 150s | 0.02…6s | U5 | U5 2…10V | P-20038 | NO | manual |
| **W39** | 150s | 0.59…2.93s | U5 | U5 2…10V | P-20039 | NO | auto-adapt. |
| **W3A** | 150s | 0.5…5.0s | U5 | U5 2…10V | P-20040 | NO | auto-adapt. |
| **W3C** | | | | | | | |
| **W3D** | | | | | | | |
| **W3E** | | | | | | | |
| **W3F** | | | | | | | |
| **W3G** | | | | | | | |
| **W3H** | | | | | | | |
| **W3J** | | | | | | | |
| **W3K** | | | | | | | |
| **W3L** | | | | | | | |
| **W3M** | | | | | | | |
| **W3N** | | | | | | | |
| **W3P** | | | | | | | |
| **W3R** | | | | | | | |
| **W3S** | | | | | | | |
| **W3T** | | | | | | | |
| **W3U** | | | | | | | |
| **W3V** | | | | | | | |
| **W3W** | | | | | | | |
| **W3X** | | | | | | | |
| **W40** | | | | | | | |
| **W41** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **F01** | 150s | --- | U5 | U5 2…10V | P-30001 | NO | manual |
| **F02** | 150s | --- | U5 | U5 0.5…10V | P-30002 | NO | manual |
| **F03** | 100s | --- | U5 | U5 2…10V | P-30003 | NO | manual |
| **F04** | 100s | --- | U5 | U5 0.5…5V | P-30004 | NO | manual |
| **F05** | 100s | --- | U5 | U5 0.5…10V | P-30005 | NO | manual |
| **F06** | 150s | --- | U5 | U5 0.5…5V | P-30006 | NO | manual |
| **F07** | 300s | --- | U5 | U5 2…10V | P-30007 | NO | manual |
| **F08** | 75s | --- | U5 | U5 2…10V | P-30008 | NO | manual |
| **F09** | 85s | --- | U5 | U5 2…10V | P-30009 | NO | manual |
| **F10** | 150s | --- | U5 | U5 0.5…6V | P-30010 | NO | manual |
| **F11** | 75s | --- | U5 | U5 0.5…5V | P-30011 | NO | manual |
| **F13** | 120s | --- | U5 | U5 0.5…10V | P-30013 | NO | manual |
| **F14** | 90s | --- | U5 | U5 2…10V | P-30014 | NO | manual |
| **F15** | 150s | --- | U5 | U5 0.5…4.5V | P-30015 | NO | manual |
| **F16** | 150s | --- | U5 | U5 1…5V | P-30016 | NO | manual |
| **F17** | 90s | --- | U5 | U5 1…10V | P-30017 | NO | manual |
| **F18** | 60s | --- | U5 | U5 2…10V | --- | NO | manual |
| **F19** | 45s | --- | U5 | U5 2…10V | --- | NO | manual |
| **F1A** | 35s | --- | U5 | U5 2…10V | --- | NO | manual |
| **F1C** | | | | | | | |
| **F1D** | | | | | | | |
| **F1E** | | | | | | | |
| **F1F** | | | | | | | |
| **F1G** | 120s | --- | U5 | U5 2...10V | --- | NO | manual |
| **F1H** | 450s | --- | U5 | U5 2…10V | --- | NO | manual |
| **F1J** | | | | | | | |
| **F1K** | | | | | | | |
| **F1L** | | | | | | | |
| **F1M** | | | | | | | |
| **F1N** | | | | | | | |
| **F1P** | | | | | | | |
| **F1R** | | | | | | | |
| **F1S** | | | | | | | |
| **F1T** | | | | | | | |
| **F1U** | | | | | | | |
| **F1V** | | | | | | | |
| **F1W** | | | | | | | |
| **F1X** | | | | | | | |
| **F20** | | | | | | | |
| **F21** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **J01** | 75s | --- | U5 | U5 2…10V | P-40001 | NO | manual |
| **J02** | 150s | --- | U5 | U5 2…10V | P-40002 | NO | manual |
| **J03** | 75s | --- | U5 | U5 2…10V | P-40003 | NO | manual |
| **J04** | 100s | --- | U5 | U5 0.5…5V | P-40004 | NO | manual |
| **J05** | 100s | --- | U5 | U5 0.5…10V | P-40005 | NO | manual |
| **J06** | 120s | --- | U5 | U5 2…10V | P-40006 | NO | manual |
| **J07** | 45s | --- | U5 | U5 2…10V | P-40007 | NO | manual |
| **J08** | 200s | --- | U5 | U5 2…10V | P-40008 | NO | manual |
| **J09** | 120s | --- | U5 | U5 0.5…10V | P-40009 | NO | manual |
| **J10** | 300s | --- | U5 | U5 2…10V | P-40010 | NO | manual |
| **J11** | 150s | --- | U5 | U5 0.5…10V | P-40011 | NO | manual |
| **J13** | 100s | --- | U5 | U5 0.5…5V | P-40012 | NO | manual (off) |
| **J14** | | | | | | | |
| **J15** | | | | | | | |
| **J16** | | | | | | | |
| **J17** | | | | | | | |
| **J18** | | | | | | | |
| **J19** | | | | | | | |
| **J1A** | | | | | | | |
| **J1C** | | | | | | | |
| **J1D** | | | | | | | |
| **J1E** | | | | | | | |
| **J1F** | | | | | | | |
| **J1G** | | | | | | | |
| **J1H** | | | | | | | |
| **J1J** | | | | | | | |
| **J1K** | | | | | | | |
| **J1L** | | | | | | | |
| **J1M** | | | | | | | |
| **J1N** | | | | | | | |
| **J1P** | | | | | | | |
| **J1R** | | | | | | | |
| **J1S** | | | | | | | |
| **J1T** | | | | | | | |
| **J1U** | | | | | | | |
| **J1V** | | | | | | | |
| **J1W** | | | | | | | |
| **J1X** | | | | | | | |
| **J20** | | | | | | | |
| **J21** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **T01** | 2.5s | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **T02** | 4s | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **T03** | 7s | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **T04** | 10s | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **T05** | 15s | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **T06** | 20s | 2…10V | U5 | U5 2...10V | --- | NO | manual |
| **T07** | 2.5s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **T08** | 4s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **T09** | 7s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **T0A** | 10s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **T0C** | 15s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **T0D** | 20s | 0.5…10V | U5 | U5 0.5...10V | --- | NO | manual |
| **T0E** | | | | | | | |
| **T0F** | | | | | | | |
| **T0G** | | | | | | | |
| **T0H** | | | | | | | |
| **T0J** | | | | | | | |
| **T0K** | | | | | | | |
| **T0L** | | | | | | | |
| **T0M** | | | | | | | |
| **T0N** | | | | | | | |
| **T0P** | | | | | | | |
| **T0R** | | | | | | | |
| **T0S** | | | | | | | |
| **T0T** | | | | | | | |
| **T0U** | | | | | | | |
| **T0V** | | | | | | | |
| **T0W** | | | | | | | |
| **T0X** | | | | | | | |
| **T10** | | | | | | | |
| **T11** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **S01** | 150s | Phasecut | U5 | U5 2…10V | | NO | manual |
| **S02** | 35s | Phasecut | U5 | U5 2…10V | | NO | manual |
| **S03** | 45s | Phasecut | U5 | U5 2…10V | | NO | manual |
| **S04** | 90s | Phasecut | U5 | U5 2…10V | | NO | manual |
| **S05** | | | | | | | |
| **S06** | 150s | 4…20mA | U5 | U5 2…10V | | NO | manual |
| **S07** | | | | | | | |
| **S08** | 45s | 4…20mA | U5 | U5 2…10V | | NO | manual |
| **S09** | 90s | 4…20mA | U5 | U5 2…10V | | NO | manual |
| **S0A** | | | | | | | |
| **S0C** | 75s | 4…20mA | U5 | U5 2…10V | | NO | manual |
| **S0D** | 75s | Phasecut | U5 | U5 2…10V | | NO | manual |
| **S0E** | | | | | | | |
| **S0F** | | | | | | | |
| **S0G** | | | | | | | |
| **S0H** | | | | | | | |
| **S0J** | | | | | | | |
| **S0K** | | | | | | | |
| **S0L** | | | | | | | |
| **S0M** | | | | | | | |
| **S0N** | | | | | | | |
| **S0P** | | | | | | | |
| **S0R** | | | | | | | |
| **S0S** | | | | | | | |
| **S0T** | | | | | | | |
| **S0U** | | | | | | | |
| **S0V** | | | | | | | |
| **S0W** | | | | | | | |
| **S0X** | | | | | | | |
| **S10** | | | | | | | |
| **S11** | | | | | | | |

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| Programmable Code | Running Time | Control Range | Feedback | Feedback Range | Obsolete Code | MP Bus Logo | Adaption |
|---|---|---|---|---|---|---|---|
| **N01** | 150s | 2…10V | U5 | U5 2...10V | V-10001 | NO | manual |
| **N02** | 150s | 0.5…10V | U5 | U5 0.5…10V | V-10002 | NO | manual |
| **N03** | 150s | 2…10V | U5 | U5 0.5…5V | V-10003 | NO | manual |
| **N04** | 150s | 4…7V | U5 | U5 2...10V | V-10004 | NO | manual |
| **N05** | 150s | 6…9V | U5 | U5 2...10V | V-10005 | NO | manual |
| **N06** | 150s | 10.5…13.5V | U5 | U5 2...10V | V-10006 | NO | manual |
| **N07** | 150s | 0.5…5V | U5 | U5 2...10V | V-10007 | NO | manual |
| **N08** | 150s | 0.5…5V | U5 | U5 0.5…10V | V-10008 | NO | manual |
| **N09** | 150s | 5…10V | U5 | U5 2...10V | V-10009 | NO | manual |
| **N10** | 150s | 5…10V | U5 | U5 0.5…10V | V-10010 | NO | manual |
| **N11** | 150s | 0.5…5V | U5 | U5 0.5…5V | V-10011 | NO | manual |
| **N12** | 150s | 0.5…5V | U5 | U5 0.5…2.5V | V-10012 | NO | manual |
| **N13** | 150s | 0.5…10V | U5 | U5 2...10V | V-10013 | NO | manual |
| **N14** | 150s | 0.5…10V | U5 | U5 0.5…2.5V | V-10014 | NO | manual |
| **N15** | 150s | 2…5V | U5 | U5 2...10V | V-10015 | NO | manual |
| **N16** | 150s | 2…6V | U5 | U5 2...10V | V-10016 | NO | manual |
| **N17** | 150s | 6…10V | U5 | U5 2...10V | V-10017 | NO | manual |
| **N18** | 150s | 14…17V | U5 | U5 2...10V | V-10018 | NO | manual |
| **N19** | 100s | 2…10V | U5 | U5 2...10V | V-10019 | NO | manual |
| **N1A** | 150s | 5.1…10V | U5 | U5 5.1...10V | V-10023 | NO | manual |
| **N1C** | 75s | 2…10V | U5 | U5 2...10V | V-10025 | NO | manual |
| **N1D** | 150s | 5…9V | U5 | U5 2...10V | V-10027 | NO | manual |
| **N1E** | 100s | 0.5…10V | U5 | U5 0.5…10V | V-10028 | NO | manual |
| **N1F** | 150s | 3…6V | U5 | U5 2...10V | V-10041 | NO | manual |
| **N1G** | 150s | 0.5…2.5V | U5 | U5 2...10V | V-10043 | NO | manual |
| **N1H** | 150s | 7…10V | U5 | U5 2...10V | V-10044 | NO | manual |
| **N1J** | 150s | 0.5…20V | U5 | U5 2...10V | V-10047 | NO | manual |
| **N1K** | 150s | 0.5…4.5V | U5 | U5 0.5…4.5V | V-10063 | NO | manual |
| **N1L** | 150s | 5.5…10V | U5 | U5 5.5…10V | V-10064 | NO | manual |
| **N1M** | 150s | 2…15V | U5 | U5 2...10V | V-10071 | NO | manual |
| **N1N** | 76s | 0.5…10V | U5 | U5 0.5…10V | V-10077 | NO | manual |
| **N1P** | 75s | 2…6V | U5 | U5 2...10V | V-10078 | NO | manual |
| **N1R** | 75s | 6…10V | U5 | U5 2...10V | V-10079 | NO | manual |
| **N1S** | 150s | 3…7V | U5 | U5 2...10V | V-10082 | | manual |
| **N1T** | 150s | 0.59…2.93s | U5 | U5 2...10V | V-20001 | NO | manual |
| **N1U** | 150s | 0.02…5s | U5 | U5 2...10V | V-20002 | NO | manual |
| **N1V** | 150s | 0.1…25.5s | U5 | U5 2...10V | V-20003 | NO | manual |
| **N1W** | 150s | 0.1…25.6s | U5 | U5 2...10V | V-20004 | NO | manual |
| **N1X** | 150s | 0.1…5.2s | U5 | U5 0.5…5V | V-20005 | NO | manual |
| **N20** | 150s | 0.59…2.93s | U5 | U5 0.5…5V | V-20006 | NO | manual |
| **N21** | 150s | 0.02…5s | U5 | U5 2...10V | V-20007 | NO | manual |
| **N22** | 150s | 0.1…5.2s | U5 | U5 2...10V | V-20021 | NO | manual |
| **N23** | 150s | 0.5…4.5s | U5 | U5 2...10V | V-20040 | NO | manual |
| **N24** | 150s | --- | U5 | U5 2...10V | V-30001 | NO | manual |
| **N25** | 150s | --- | U5 | U5 0.5…10V | V-30002 | NO | manual |
| **N26** | 150s | --- | U5 | U5 0.5…5V | V-30006 | NO | manual |
| **N27** | 75s | --- | U5 | U5 2...10V | V-30008 | NO | manual |
| **N28** | 75s | --- | U5 | U5 2...10V | V-40001 | NO | manual |
| **N29** | 150s | --- | U5 | U5 2...10V | V-40002 | NO | manual |
| **N30** | 100s | --- | U5 | U5 0.5…5V | V-40004 | NO | manual |
| **N3A** | 100s | --- | U5 | U5 0.5…10V | V-40005 | NO | manual |

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| Programmable Code | Loss of Control Signal | Input Signal | Feedback | Output Signal |
|---|---|---|---|---|
| **ACE** | stop | 2…10V | U5 | U5 2...10V |
| **ACF** | stop | 0.5…10V | U5 | U5 0.5...10V |
| **ACG** | stop | 4…20mA | U5 | U5 4…20mA |
| **ACH** | stop | 4…20mA | U5 | U5 2...10V |
| **ACJ** | open | 2…10V | U5 | U5 2...10V |
| **ACK** | open | 0.5…10V | U5 | U5 0.5...10V |
| **ACL** | open | 4…20mA | U5 | U5 4…20mA |
| **ACM** | open | 4…20mA | U5 | U5 2...10V |
| **ACN** | close | 2…10V | U5 | U5 2...10V |
| **ACP** | close | 0.5…10V | U5 | U5 0.5...10V |
| **ACR** | close | 4…20mA | U5 | U5 4…20mA |
| **ACS** | close | 4…20mA | U5 | U5 2...10V |

* Runtime is fixed based on actuator model.

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# PC-Tool Accessories

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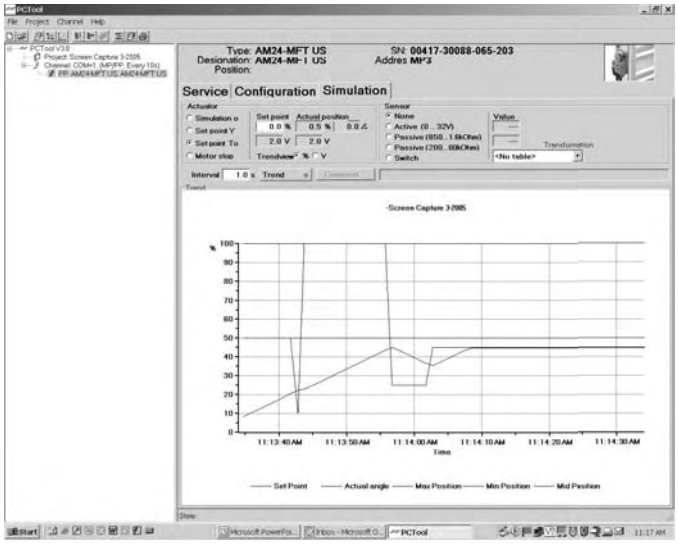


| Technical Data | MFT-P US |
|---|---|
| Software version | 3.X |
| Compatible Operating System | For Windows 2000/XP/Vista |
| System requirements | 10 MB free hard disk space |
| Modules | MFT-PC |
| Language | English / German |
| CD contents | Set-up.exe (Installation tool)<br>Software documentation<br>(requires Adobe Acrobat Reader)<br>Adobe Acrobat Reader |
| License | Not required |

## Application

The Belimo PC-Tool software is a graphical user interface which allows the user to set, modify and read actuator characteristics.

The Belimo PC-Tool is an MFT support tool which is a practical solution for Controls distributors and Installation contractors.

**The Controls Distributor can:**

- Reduce inventory levels
- Optimize the flexible MFT product inventory
- Quickly program an MFT actuator
- Provide MFT custom retrofit solutions – same day
- Re-label the actuator with correct parameters

**The Installation contractor or field technician can:**

- Work with PCs having a dedicated hand held tool
- Connect and program actuators quickly on an as needed basis
- Get systems up and running faster for service replacement applications
- Optimize flexibility of MFT product inventory for replacement applications
- Program actuators to your company standard configuration

## Required Accessory

| | |
|---|---|
| **ZIP-RS232 US** | (required) |
| OR | |
| **ZIP-USB-MP** | (required) |
| AND | |
| **ZK Cable** | depending upon application (required) |

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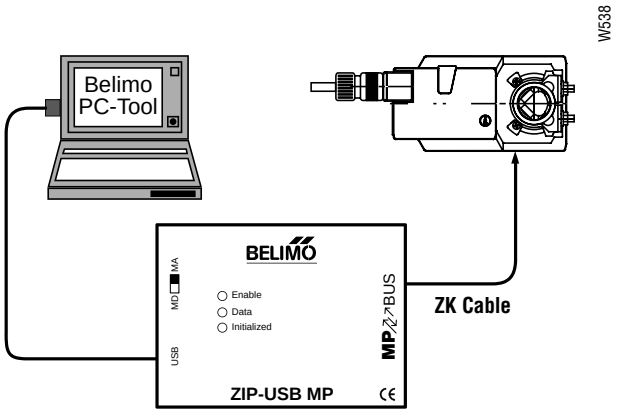
# ZIP-USB-MP US

**For interfacing PC with…MFT US type actuators**

| Technical Data | ZIP-USB-MP US |
|---|---|
| Power Supply | AC 24 V 50/60 Hz, DC 24V |
| Nominal voltage range | AC 19.2…28.8 V, DC 21.6…28.8 V |
| Driver | For Windows 2000, XP or Vista (download at www.belimo.com, call for link) |
| Connections USB | USB 2.0, 1 m cable |
| MP device | RJ11-socket |
| Electrical Safety | III safety extra-low voltage |
| Degree of protection | IP 20 |
| Ambient temperature | 0 to 122 °F |
| Storage temperature | -40 to 176 °F |
| Weight | <1.0 lb |

**Wiring Diagram**




## Application

The ZIP-USB-MP is used with the Belimo PC-Tool software (MFT-P US) to interface all Multifunctional (…MFT US) type actuators via a USB port. Monitoring and parameterization of one MFT actuator is enabled.

The ZIP-USB-MP can also be used to interface the MFT actuators functionality via the UK24LON.

## Connection and Operation

**Power Supply**
Power for the ZIP-USB-MP is supplied via the connected MFT actuator. The Actuator needs to be powered up in order for the unit to work.

**Connection and Indication**
A PC is connected through its USB port and the associated ZK cable.

**NOTE:** A special driver found on the Belimo website is needed for the ZIP-USB-MP US to operate. Contact factory for details.

**Indication** (See Accessories)
LED's show the status of the interface and the flow of data between the ZIP-USB MP and the MFT actuator/VAV controller.

**LED *Initialized***
Data is transmitted from ZIP-USB-MP to actuator.

**LED *Data***
- Data transmitted from actuator to ZIP-USB-MP.
- LED flashes synchronously when initlaized if an actuator does not respond.

**LED *Enable***
Steady light when the interface is active.

## Accessories

| | |
|---|---|
| **ZK1-GEN** | Cable 16 ft, RJ11-plug |
| **ZK2-GEN** | Cable 16 ft, RJ11-plug, open wires |
| **ZK3-GEN** | Cable 16 ft, diagnostic socket, plug |
| **ZK6** | Use with SY actuator |
| **ZKS-MP** | Use with UK24LON US gateway |
| **ZK1-VAV** | Use with VAV actuators |

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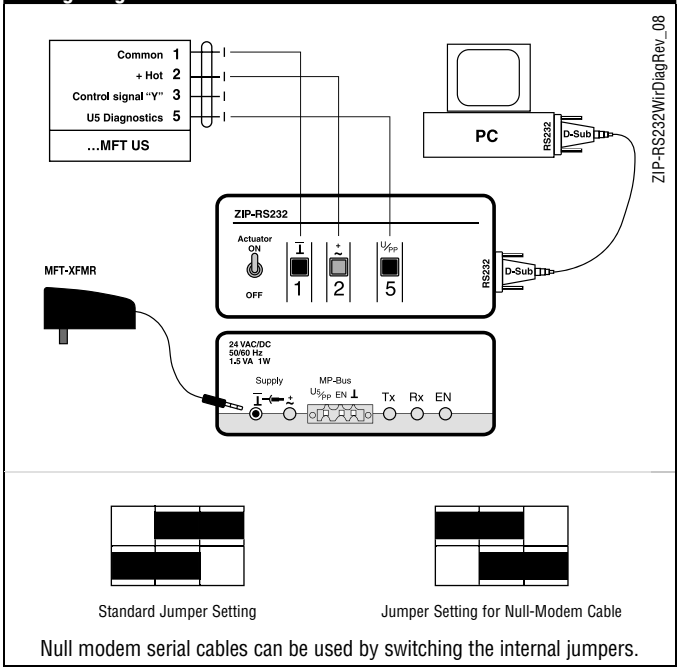
**ZIP-RS232**

| Technical data | | ZIP-RS232 US |
|---|---|---|
| Supply voltage | | 24 VAC; Class II power supply |
| Power consumption | | 1 W / 1.5 VA (without actuator) |
| Electrical protection | | MFT-XFMR is internally protected and automatically resets |
| Connections | Power supply | Stereo connector |
| | Actuator | Manual push button terminals |
| | MP-Bus | Orange male connector, ZKS-MP (Optional) |
| | RS232 | PC cable, sub-D, 9 pin, female/female, included |
| Ambient temperature | | 0° to 122°F |
| Storage temperature | | -40°F to 176°F |
| Electrical safety | | Class III |
| Weight | | <1.0 lb. (without actuator) |

## Wiring Diagram






Standard Jumper Setting

Jumper Setting for Null-Modem Cable

Null modem serial cables can be used by switching the internal jumpers.

## Application

The ZIP-RS232 is used with the Belimo PC-Tool software (MFT-P US) to interface all Multifunctional (…MFT US) type actuators via an RS232 port. Monitoring and parameterization of one MFT actuator is enabled.

The ZIP-RS232 can also be used to interface the MFT actuators functionality via the UK24LON.

## Connection and Operation

**Wiring Terminals**

The …MFT US actuator wires are connected to the terminals and correspond to the conductor wire designations. Some actuators are color coded and do not have numbered conductors. The following indications should be used:

1 = Black
2 = Red
5 = Orange (non-spring, TF)
Green (LF)
White (AF, NF)

**Switch**

The Actuator On/Off switch on the ZIP-RS232 applies 24 VAC power to the connected actuator. The ZIP-RS232 is powered when the MFT-XFMR is plugged into a power receptacle.

**RS232 Connector**

The ZIP-RS232 is connected via this RS232 connector to the PC with a standard female-female 9-pin sub-D cable, provided.

**Power Supply**

The MFT-XFMR accessory transformer is connected to the unit, and supplies 24 VAC power to the ZIP-RS232 and up to one connected actuator.

**Power LED**

A Green LED is lit when 24 VAC is supplied.

**MP-Bus Connector**

This connection is used only with the UK24LON or another MP-Master device.

**Terminal Designations**

U/PP: Data communications lead EN: Enabling signal for UK24LON

**MP-Bus LED's**

**Tx:** LED flashes when data flows from ZIP-RS232 to the …MFT US actuator.
**Rx:** LED flashes when data flows from …MFT US actuator to ZIP-RS232
**EN:** LED is lit constantly when RS232 device is connected.
(E.g. PC is connected to ZIP-RS232)

## Accessories

| | |
|---|---|
| **MFT-XFMR** | Power transformer |
| **ZKS-MP** | MP-bus cable for use with UK24LON |

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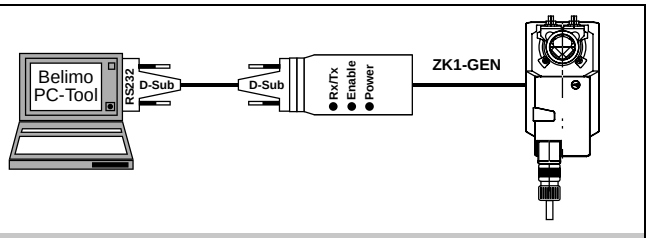
### ZK1-GEN

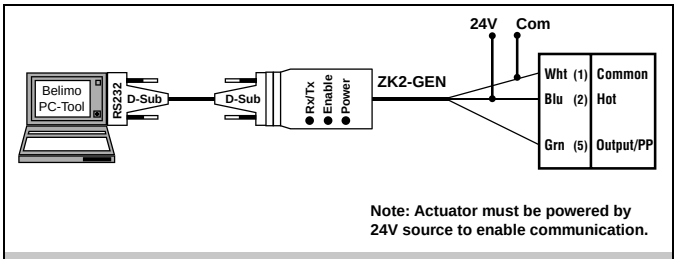
Cable for use with ZIP USB-MP or ZIP-RS232 to connect new generation non-spring return actuators via diagnostic/programming socket




**ZK1-GEN Wiring**

### ZK2-GEN

Cable to connect ZIP-RS232 with spring and non-spring return actuators not equipped with diagnostic/programming socket

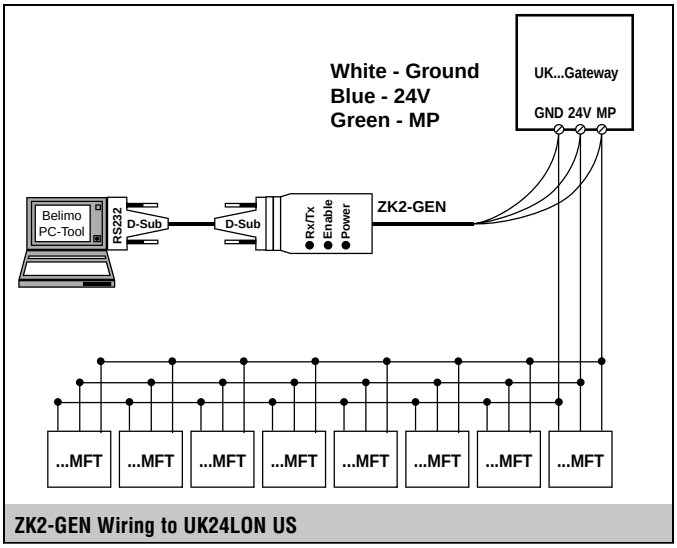



**Note: Actuator must be powered by 24V source to enable communication.**

**ZK2-GEN Wiring**

### ZK3-GEN

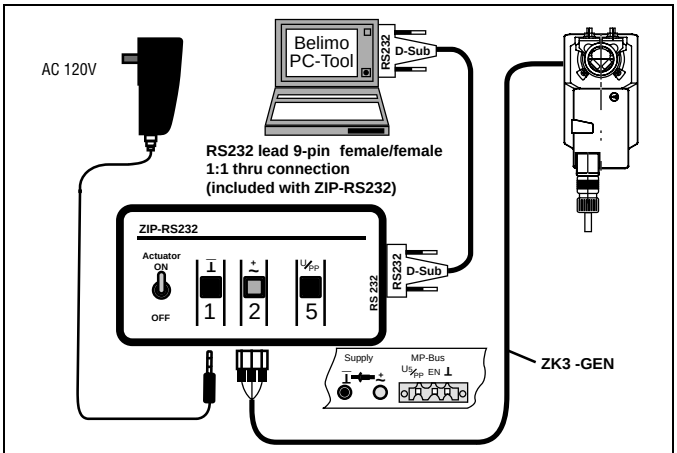
Cable to connect ZIP-RS232 or UK24LON US to new generation non-spring return actuator via diagnostic/programming socket




**ZK2-GEN Wiring to UK24LON US**

### ZK6-GEN

Cable to connect to ZIP USB-MP




**ZIP-RS232 to Actuator using ZK3-GEN**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# PC-Tool
# User Manual

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# 1 Basics

## 1.1 Introduction

The user manual describes the functions of the Belimo PC-Tool. The Belimo PC-Tool is a PC-based tool for parameterizing Belimo MFT via bus.

This document is designed to present basic information. This booklet is based on PC-Tool 3.4. Later versions may contain more features.

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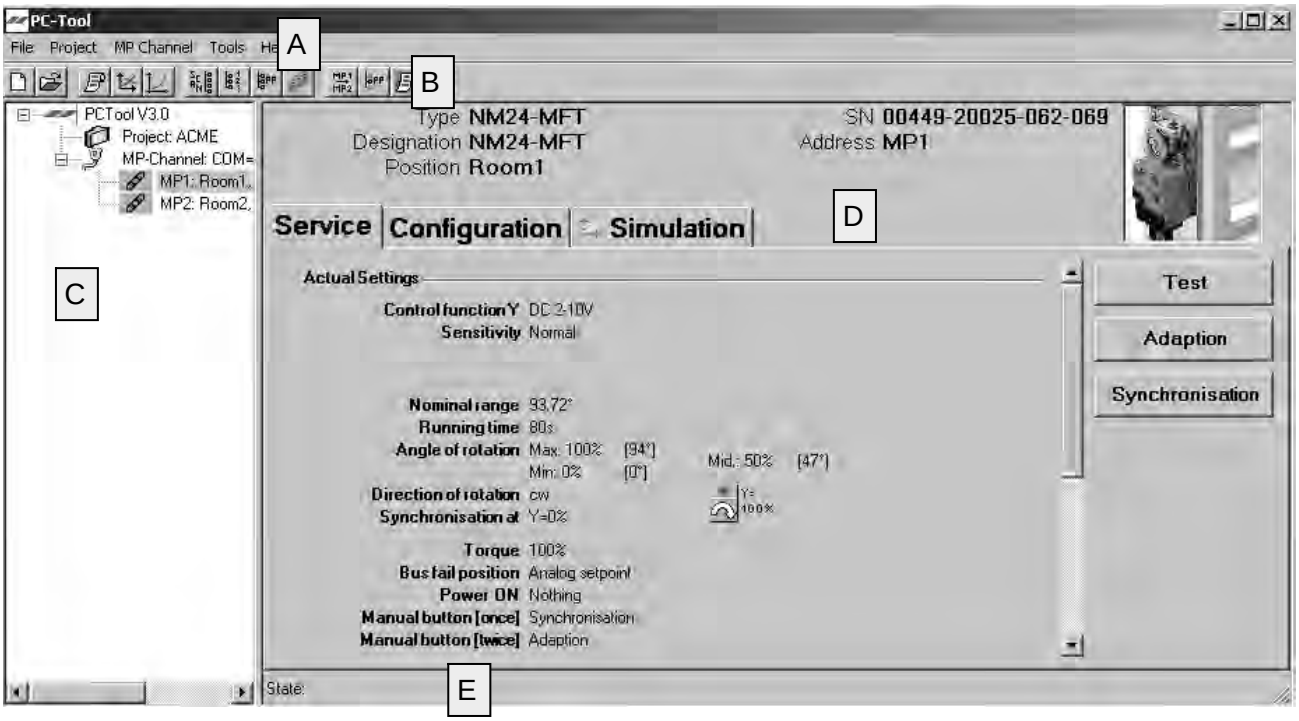
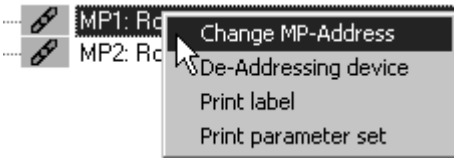
## 1.2 General structure of the user software




*User interface PC-Tool*

Menu bar [A] and toolbar [B] provide functions that affect the program as a whole. An explanatory text (tooltip) appears for each icon in the toolbar when you position the mouse pointer on it.

The MP-Channels and actuators belonging to the project are displayed in the outline bar [C] in the form of a tree (as in the Explorer). The object to be worked on is marked here. Depending on the selected object, pop-up menus offer corresponding functions at a click of the right mouse button.




*Pop-up menu after clicking the right mouse button*

The detail area [D] contains all the detailed information on the highlighted actuator. The values that are displayed and changed in this area are grouped as needed and distributed over several index tabs.

The status bar [E] at the lower margin shows the current status of the connected device (e.g.: the actuator is carrying out a synchronization or adaptation.)

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Missing or invalid entries are indicated by a flashing exclamation mark. If you move the mouse pointer to the exclamation mark, an explanatory text (tooltip) appears.

Inactive commands are displayed in gray letters (or as gray icons) according to the Windows standard.

Texts in boxes with a black font on a gray background cannot be changed. You can mark the contents with the mouse, however, and copy them into the clipboard with CTRL+C, for example.

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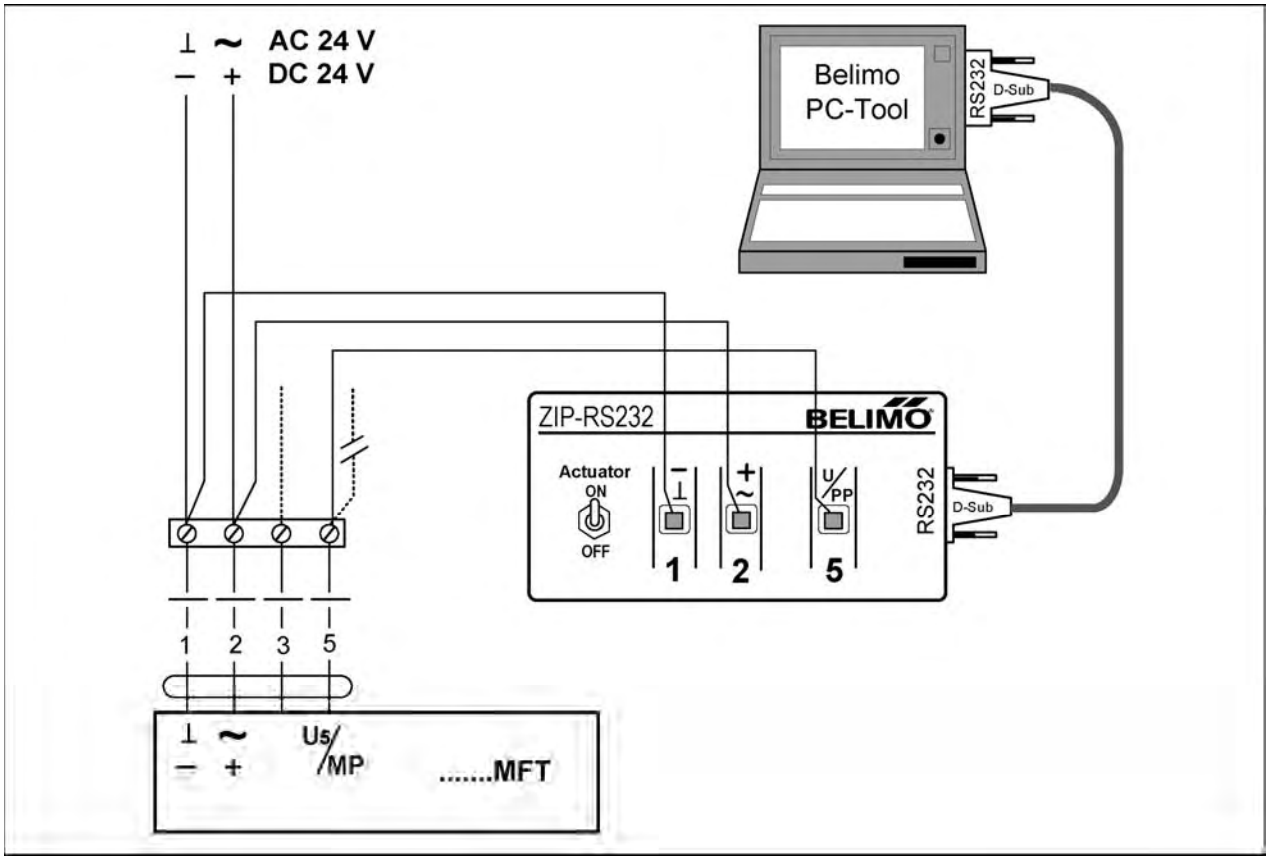
# 2 Getting started with PC-Tool

## 2.1 Connecting the computer with the actuators

There are two ways to connect the computer (PC-Tool) to the actuators, via the ZIP-RS232 or by the ZIP-USB-MP US. If the ZIP-RS232 is going to be used, follow the wiring diagram that works best for your situation.

**ZIP-RS232 via direct connection to MFT actuator.**

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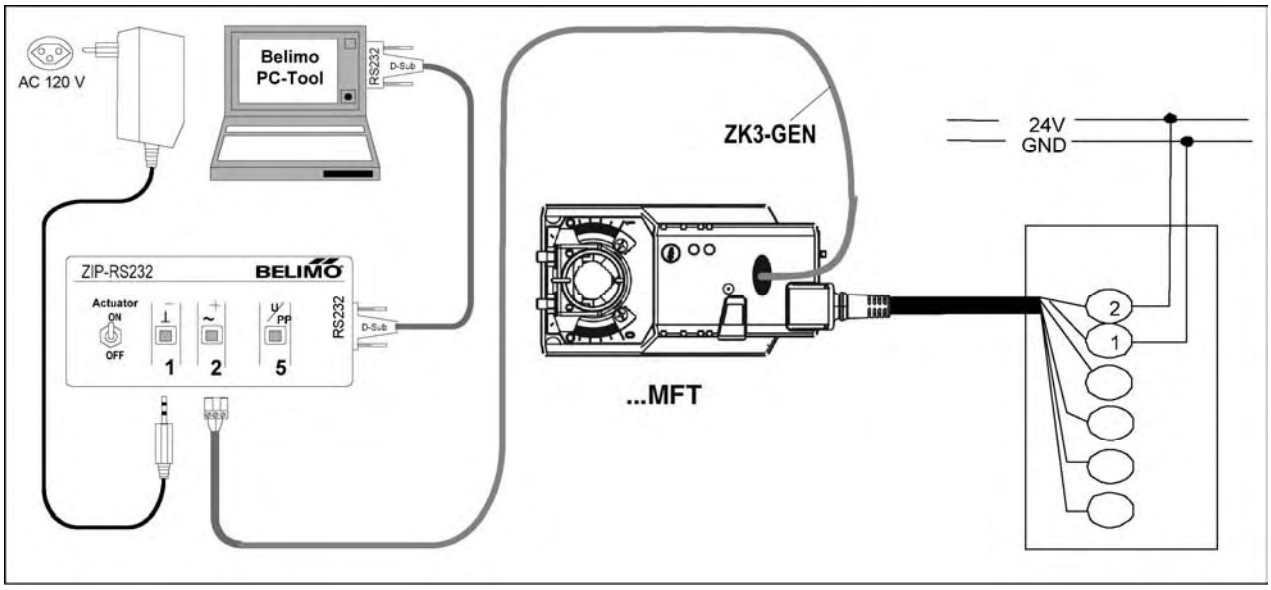
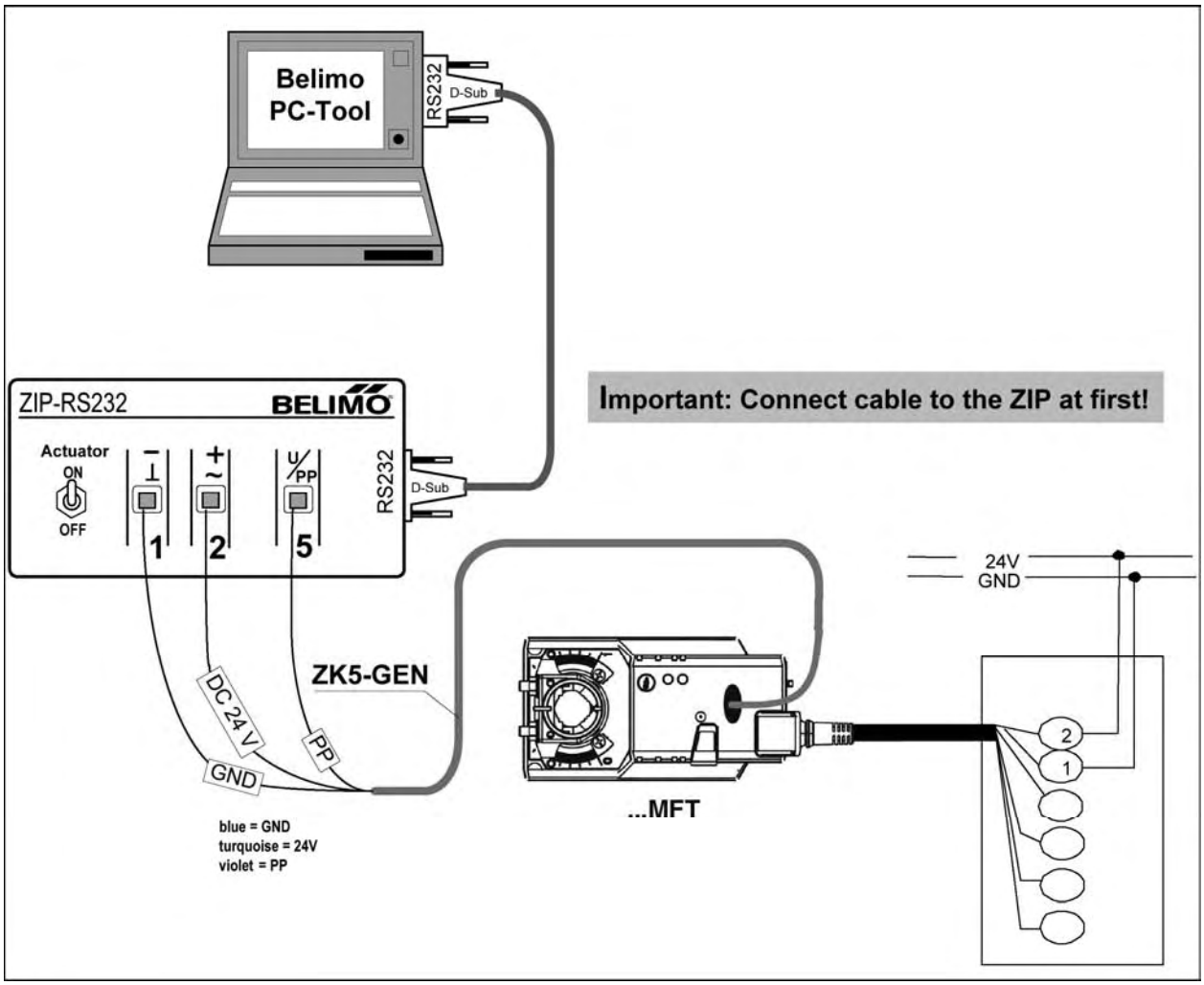
**ZIP-RS232 via ZK3-GEN to Belimo actuator.**




**ZIP-RS232 via ZK5-GEN to Belimo actuator.**

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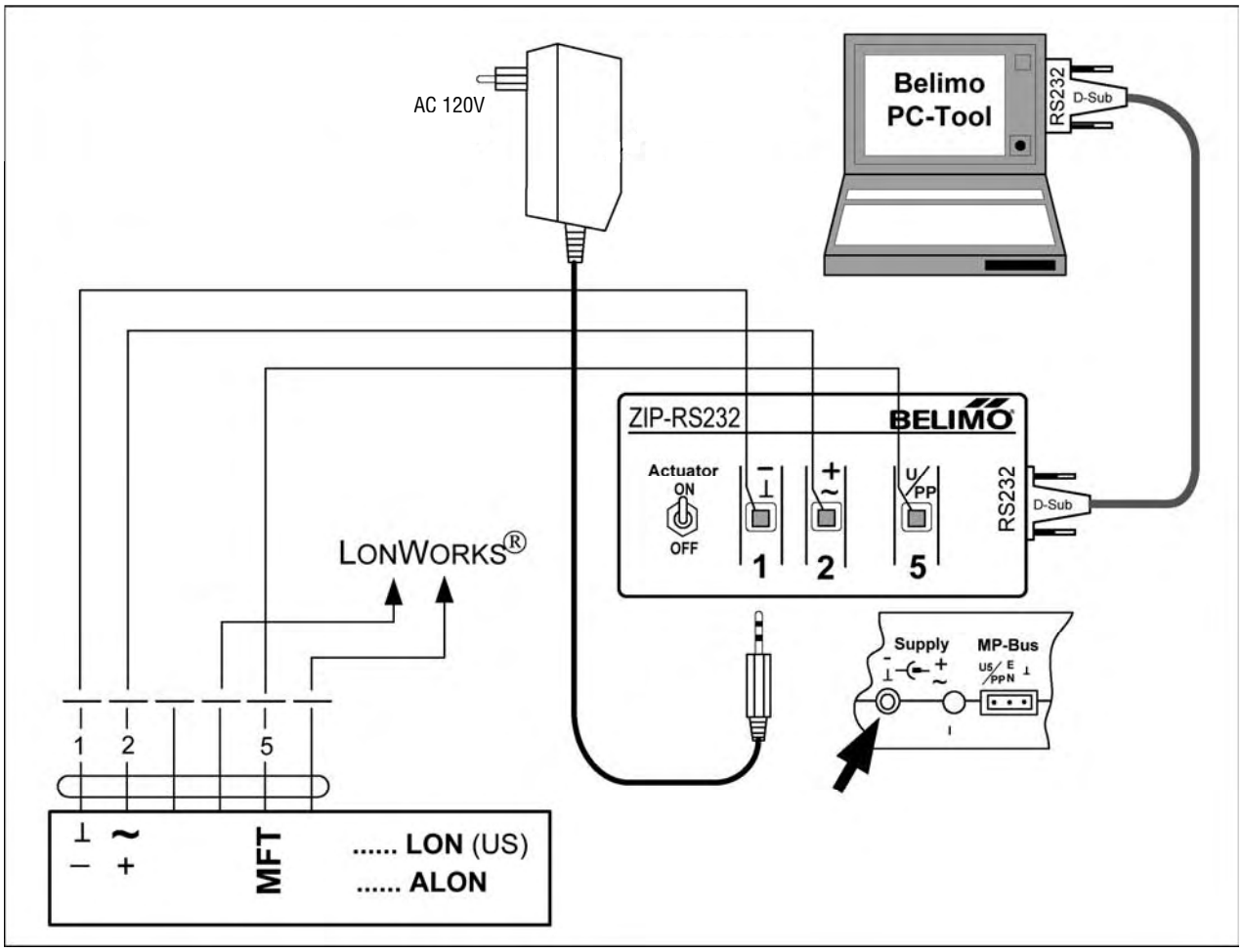
**ZIP-RS232 via direct connection to LON actuator.**

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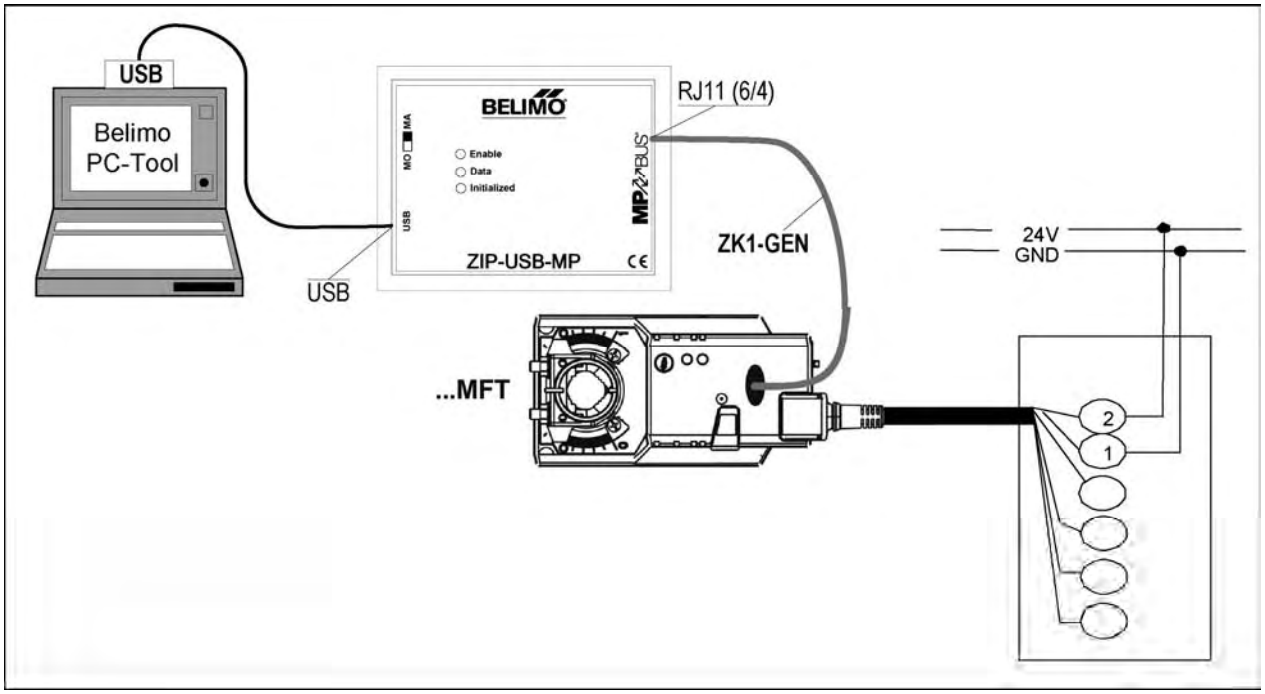
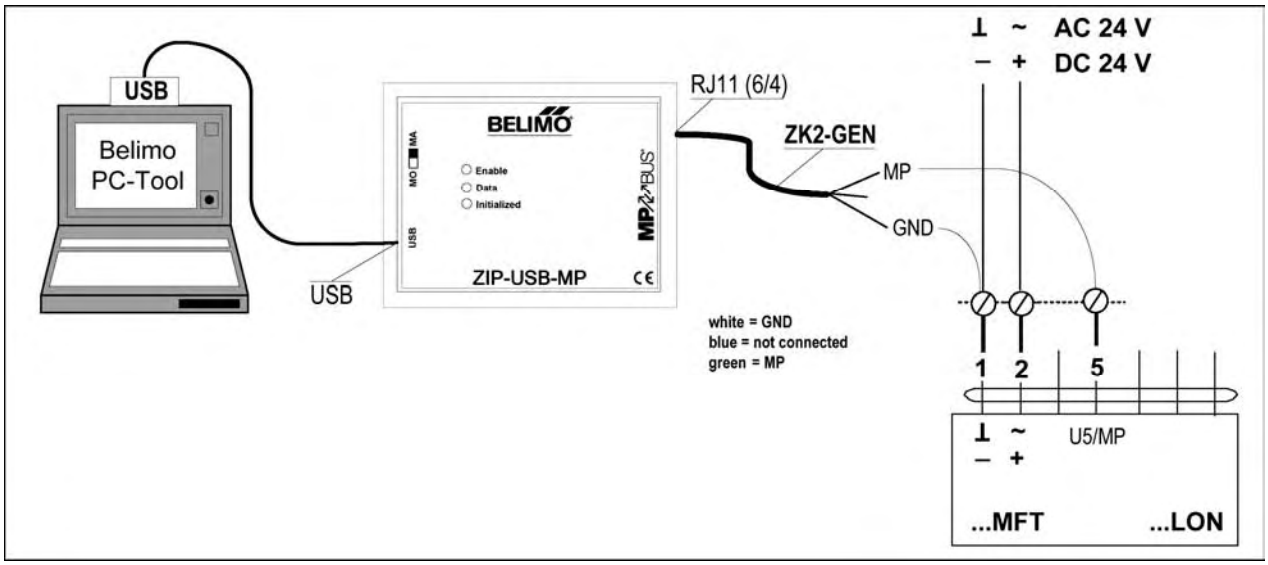
If the ZIP-USB-MP is going to be used, follow the directions to load the ZIP-USB-MP software and driver. Please note the ZIP-USB-MP is paired with the computer, if you move the ZIP-USB-MP the software and driver must be installed on the new computer.

**ZIP-USB-MP via ZK1-GEN to a Belimo actuator.**




**ZIP-USB-MP via ZK1-GEN to a Belimo actuator.**

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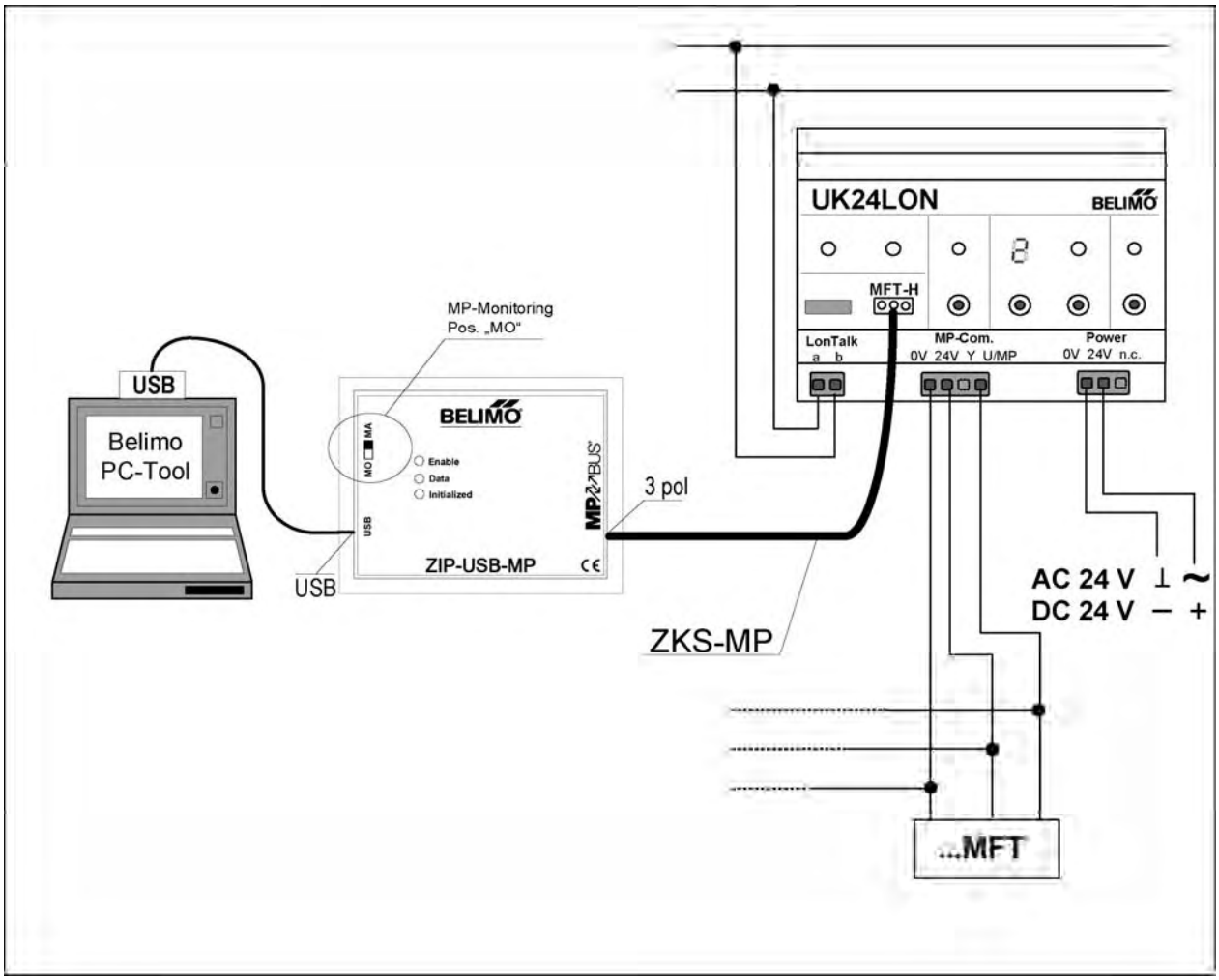
**ZIP-USB-MP via ZK1-GEN to a Belimo actuator.**

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## 2.1.1 Driver Installation

A driver must be installed on the PC in order to use the ZIP-USB-MP. This driver can be downloaded from the Belimo website (Download section). Once the driver has been installed, the ZIP-USBMP is logged in on the PC as a virtual COM port.

### Supported operating systems

Windows Vista
WindowsXP
Windows 2000
Windows ME
Windows 98
Windows 98 SE

### Preparation

Download the zipped “Driver_ZIP-USP-MP.zip” file from the Belimo website (Download section) to a folder on the hard disk of your computer. Then extract the ZIP file. The ZIP file contains the following files:

- 98_ME_zipUSBMP_Driver
- XP- 2000- ZIPUsbMP- Driver
- ZIPUSBMP_drivinst_d.pdf
- ZIPUSBMP_ drivinst_e.pdf
- ZIPUSBMP_dok_d.pdf
- ZIPUSBMP_doc_e.pdf

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## Installing

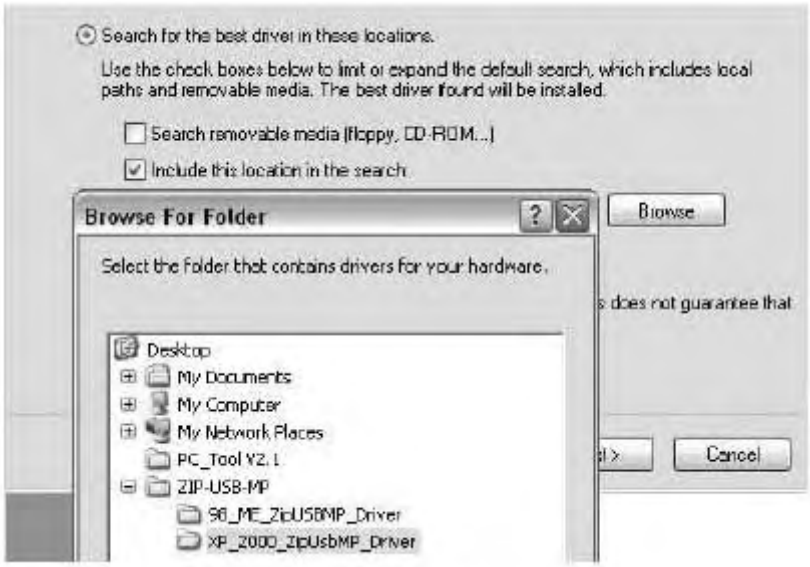
A) Connect the ZIP-USB-MP to the USB port on your computer. The computer reports that it has detected new hardware and opens the following screen automatically: **Hardware Update Wizard**.

B) Click the radio button as shown in the next screenshot: **Install from a list or specific location (Advanced)**.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
Belimo ZIP-USB-MP Interface
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

C) Then click **"Next"**.

D) Check the box as shown in the next screenshot:
Include this location in the search, then select the folder to which you extracted the driver (see step 1; in this example ZIP-USB-MP).


Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
Browse
Browse For Folder
Select the folder that contains drivers for your hardware.
Desktop
My Documents
My Computer
My Network Places
PC_Tool V2.1
ZIP-USB-MP
98_ME_ZipUSBMP_Driver
XP_2000_ZipUsbMP_Driver
Cancel

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E) Select the XP_2000_ZipUsbMP_Driver folder and then click "**OK**".

F) Click "**Next**".

Search removable media (floppy, CD-ROM...)
Include this location in the search:
c:\Documents and Settings\keelma\Desktop\ZIP-U
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

G) The driver is now installed.

H) Click "**Finish**".

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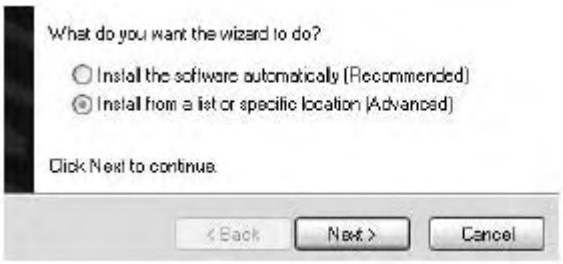
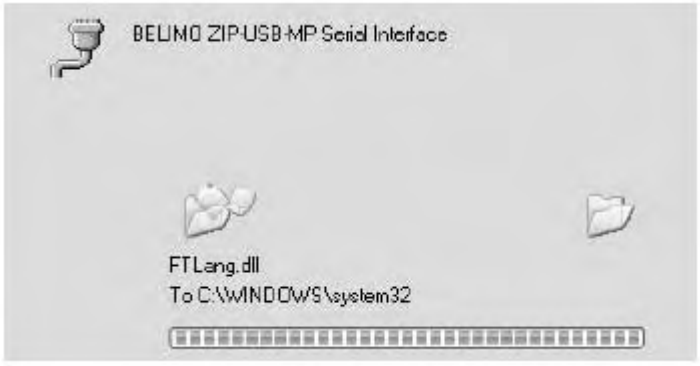
I) After the driver has been installed, the USP port must be paired to a COM port. Click the radio button in the Wizard as shown in the next screenshot: **Install from a list or specific location (Advanced).**


What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

J) Click "**Next**".

Include this location in the search:
c:\Documents and Settings\Keelma\Desktop\ZIP-U
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

K) The USB port is now paired to a COM port.




L) Click "**Finish**".

**NOTE: If a warning appears during the installation procedure, please ignore it and click "continue installation". The driver is the loaded correctly. Your system is not damaged in any way.**

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## 2.1.2 Checking

**Check the USB/COM connection on your computer.**

You must define a COM port number under "**Options**" in order to work with Belimo PC-Tool MFT-P v3. To find out which COM port number is the correct one, you need to check which COM port the USB port was automatically connected to by the system.

A) Select "**Settings/Control Panel/System**" in the Windows "**Start**" menu. On the "**Hardware**" tab, click "**Device Manager**".

B) You can see here that the USB port on the ZIP-USB-MP has been connected to COM 8, for example (a different COM number may apply on your PC).

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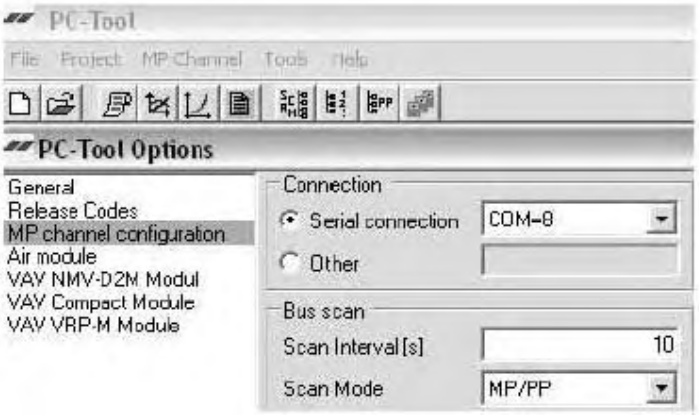
## Selecting the same COM port in PC-Tool Version 3.4

After selecting the COM port, for example "**COM=8**" (a different COM number may apply on your PC), you can set to work with the Tool.

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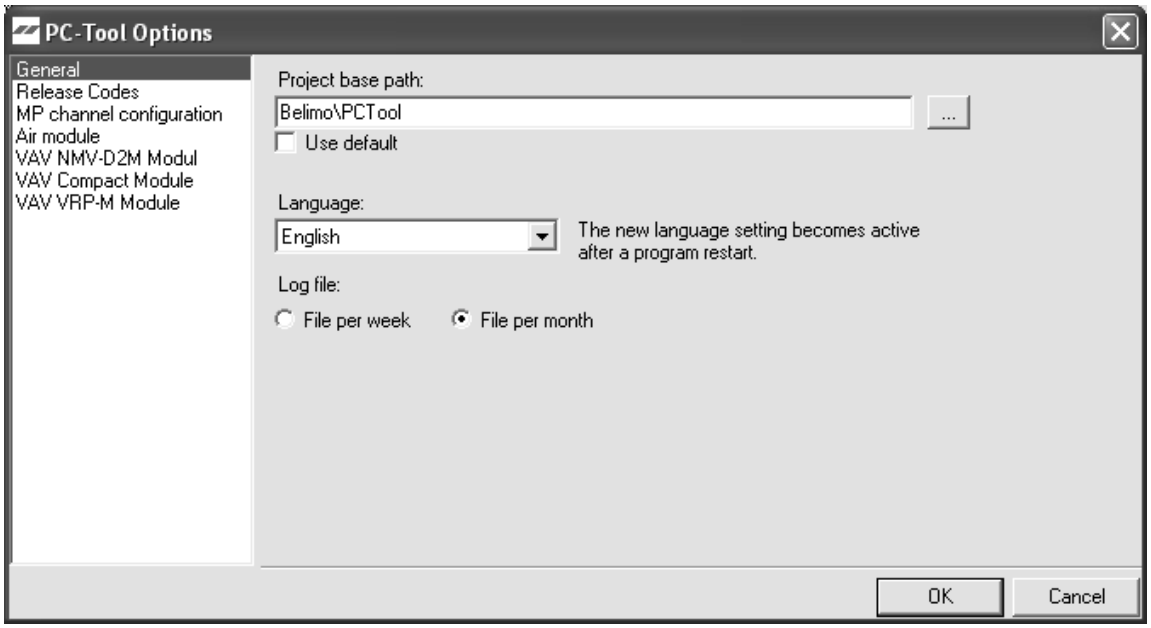
## 2.2 Starting the program

Click the program icon on your desktop. A start screen appears. Click the Start button (bottom right).

## 2.3 Adapting PC-Tool options

When you start the program for the first time, a dialog is displayed for adapting the user-specific settings.




*PC-Tool options*

Select the desired language in the combobox here. If you change the language, exit the program and restart it.

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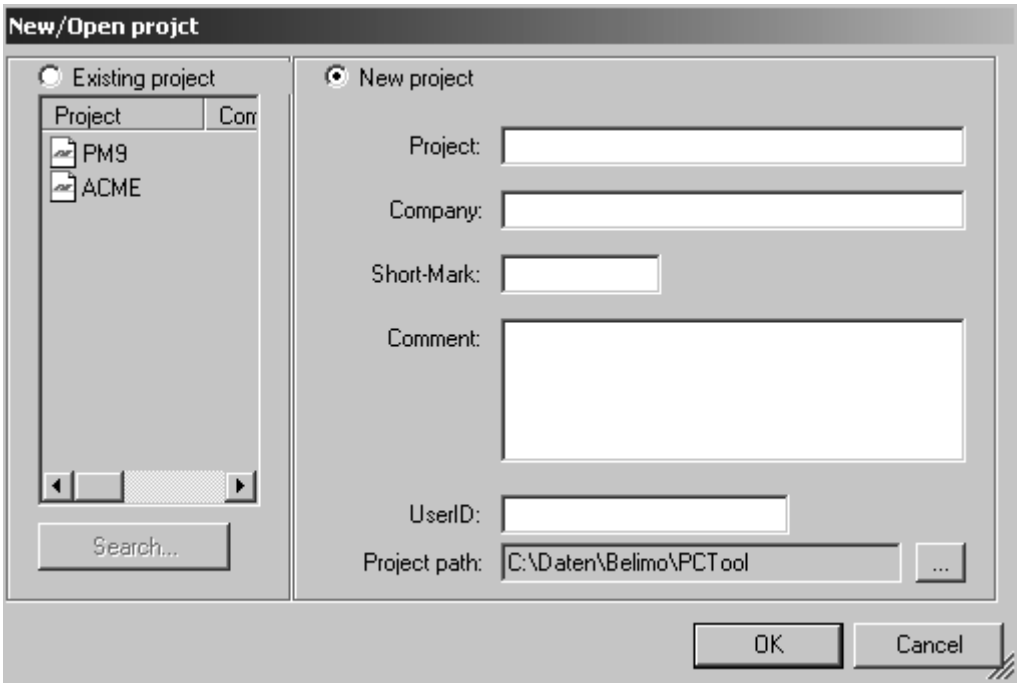
## 2.4 Creating a new project

To work with the program, you have to create a "project". The dialog for entering the project data is displayed. Click the radio button "New project".

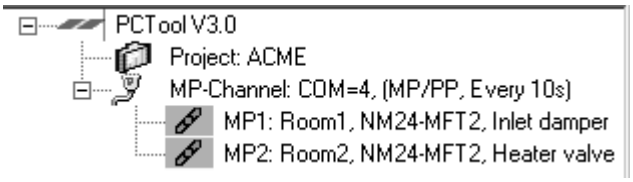



*Creating a new project*

The project name, company and user ID must be filled in; all other information is optional.

## 2.5 Setting up the program

The project and the MP-Channel can be seen in the outline bar [C]. The bus is scanned every 10 seconds by default.




*Outline bar [C]*

If no actuators are shown after 10 seconds, you should check whether the level converter ZIP-USB-MP is connected to the right COM interface. Adjust the settings for the serial interface if necessary [⇨ 3.3.1].

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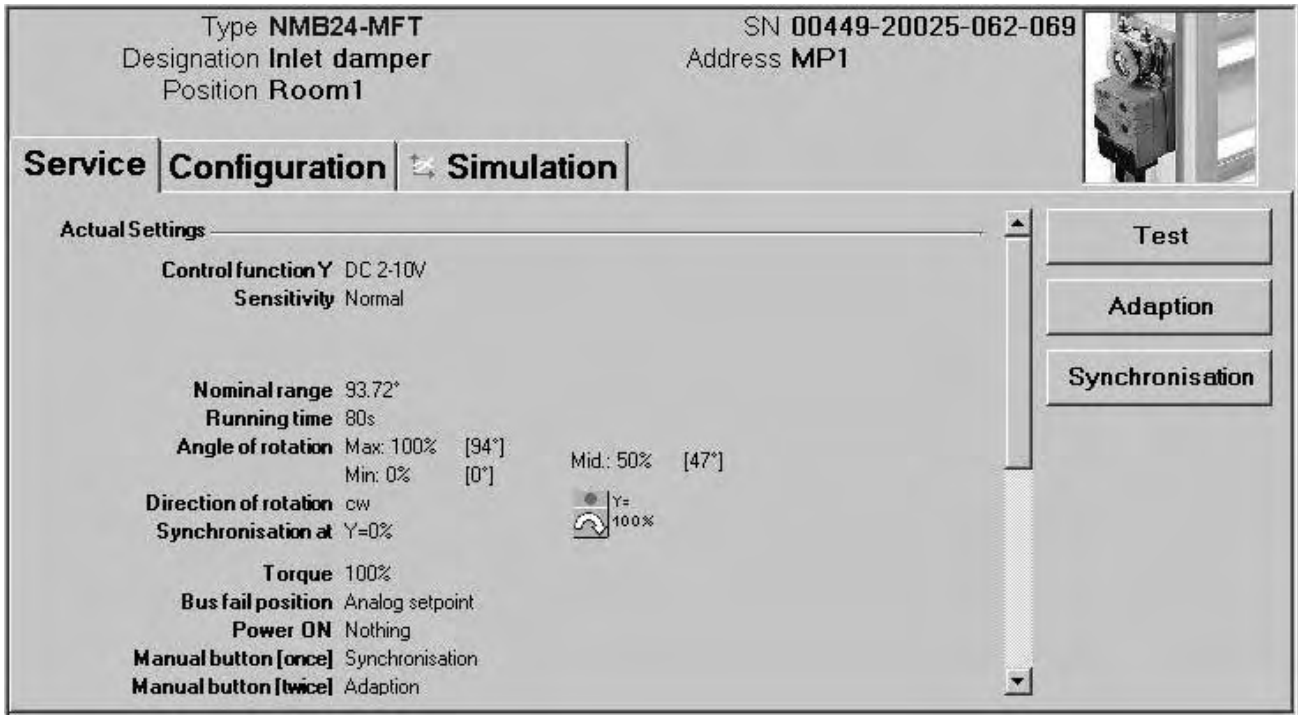
## 2.6 Displaying actuator parameters

Select the desired actuator in the outline bar [C] by clicking it with the mouse.

The current settings for the actuator are displayed in the detail area [D].




*Example of detail area [D] (damper actuator)*

## 2.7 Further actions

Read the descriptions for the following topics in Section 3 Basic functions

- Bus scan
- Setting the bus address
- Parameterization of actuators

Read the details for the application areas of the actuators in the descriptions of the following modules

- Damper actuators (Air module)

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# 3 Basic functions

## 3.1 Program start

After the program is started, a start screen is displayed. Click Start.

Determine the project with which you would like to work. You can either

- open one of the last projects listed,
- open an existing project from a file, or
- create a new project.

The defined MP-Channel is displayed and opened. A bus scan is started for each MP-Channel.

If only one actuator is connected, it is automatically selected and displayed.

Option If you cancel the project selection, the program will be started without a project. In this case, only the functions Help, File▸ New project and File ▸ Open existing project will be available.

You can also start the program by means of opening a project file: In the Explorer, double-click a file with the extension `.bptpj` or on a corresponding file link.

If you create a link to a project file on the desktop, make sure that you do not inadvertently move or copy the file instead. You can tell when a link has been created correctly by the small arrow in the bottom left-hand corner of the file icon. (If the project file itself, rather than a link to it, is on the desktop then all other files will be saved there as well.)

In a network environment, the program should be installed on your workstation and started locally. Special authorizations are required to start the program on network drives.

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## 3.2 Projects

### 3.2.1 Project data

All user-specific data of the program are administered in the framework of projects. Each project has a project directory in the file system. The project files are stored in sub-directories of the project directory.

The storage place of the project files is described in the Appendix.

### 3.2.2 Creating a new project

Select File ▸, New Project in the main menu. Enter the new project data in the dialog. The project name, company and user ID must be filled in; all other information is optional. Click OK.

Since only one project can be active at a time, the currently displayed project will be closed and the new project opened.

Option

You can also create a new project by clicking the New Project icon on the toolbar [B] or clicking the program icon in the outline bar [C] with the right mouse button and then selecting New Project.

### 3.2.3 Opening a project

Select File ▸ Open Existing Project in the main menu. A list of all project files in the storage location is displayed.

Mark a project from the list in the dialog or open any given project file (`*.bptpj`) with Find.... Click OK.

Since only one project can be active at a time, the currently displayed project will be closed and the selected project opened instead.

Option

You can also create a project by clicking on the New Project icon on the toolbar [B] or clicking the program icon in the outline bar [C] with the right mouse button and then selecting Open Project.

### 3.2.4 Changing project data

Click the project in the outline bar [C] to display the project data. The Edit button (far right) displays a dialog in which you can change the data.

Option Click the project in the outline bar [C] with the right mouse button and select Properties.

Project name and path cannot be changed within the program. However, you can rename the project file (extension `.bptpj`) using the Windows Explorer or move the entire project folder to another location. Afterwards, open the project again.

The project folder and project file can have different names – for example for backing up data. The name of the project file determines the project name.

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### 3.2.5 Exporting a project

Copy the entire project folder in the Explorer, for example onto a CD or thumbdrive.

### 3.2.6 Copying a project

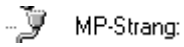
Copy the entire project folder to another location in the Explorer. Give the project folder a new name. Give the project file (<project>`.bptpj`) the same name within the new project folder.

### 3.2.7 Deleting a project

Delete the entire project folder in the Explorer. The project to be deleted must not be currently open in the program.

## 3.3 MP-Channel

### 3.3.1 Serial interface




The ZIP converter is connected to a serial interface (COM) for connecting the MP/MFT actuator or the MP-Bus to the PC-Tool. To select the number of the serial interface used on your computer, click the MP-Channel icon in the outline bar [C] and select MP-Channel settings.

For typical wiring diagrams, see ⇨ 4.4 Typical wiring diagrams

Now set the serial connection:

- If you activate the "Serial connection" box (as shown in the screenshot), you can select a serial connection. This list shows all ports on your computer (between COM=1 … COM=255).
- Option: If you activate the "Other" box, you can enter a connection ID in the text box. Valid values are:

  "*COMx*" or "*COM:x*" or "*COM=x*" (x is is the port number between 1 and 255).

  "*Baudrate=x*" (x is the baud rate 75...115200).

  "*Bytesize=x*" (x is the number of data bits 5...8).

  "*Stopbits=x*" (x is the number of stopbits 1, 1.5 or 2).

  "*Parity=x*" (x is the the parity no, odd, even, mark or space).

  It is only mandatory for the COM port to be specified. Separate the values with a semicolon (;).

  Example:

  "COM1;Baudrate=9600;Stopbits=1".

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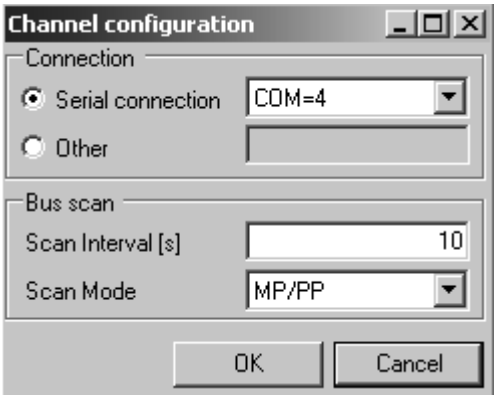


*MP-Channel settings*

## 3.3.2 Bus scan

In the bus scan section of the "MP-Channel settings" dialog, you can enter the time interval for the periodic bus scan in seconds. Permitted values are whole numbers between 1 and 9999.

The program can address actuators in two basic ways:

In multi-point mode (MP), up to 8 actuators of the types MP / MFT can be individually digitally addressed.

In point-to-point mode (PP) only a single actuator can be activated. In this case, the "classic" operating modes are available with response voltage at connection D5.

Select the type of bus scan in the bus scan section of the "MP-Channel settings" dialog:

| | |
|---|---|
| PP Only | Connection of a single actuator in PP mode |
| MP / PP | First scan address 1 to 8 in MP mode.<br>If there is no response in MP mode, switch to PP mode. |

Periodic bus scan

The periodic bus scan is active by default. To switch this off, click the MP-Channel with the right mouse button and select Interrupt scanning. Afterwards, you can switch the periodic scan back on again the same way with the menu item Scan Every xx Seconds.

Manual bus scan

Manually activate an immediate bus scan with the function button F5 ("Update") as needed. This is possible at any time, even when the periodic bus scan is active.

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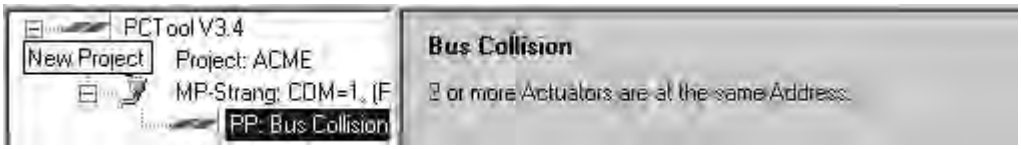
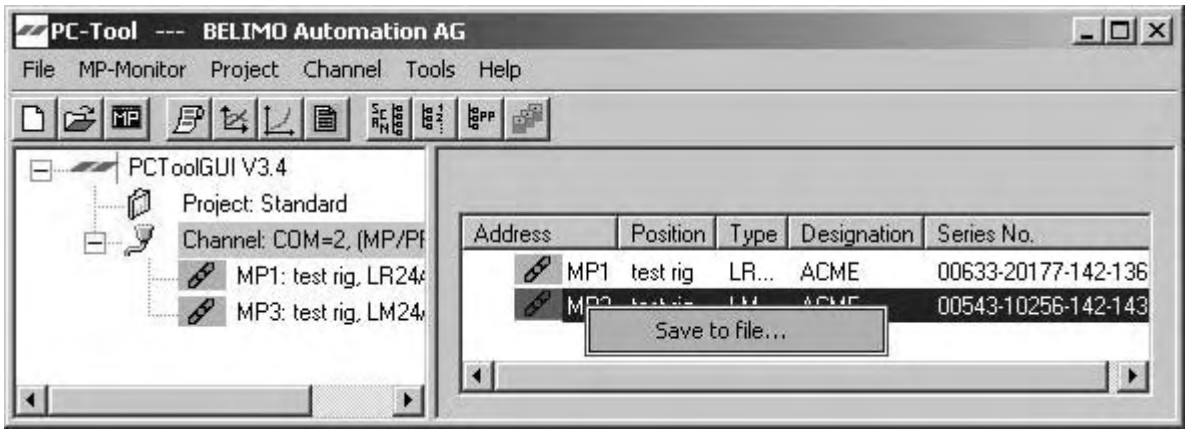
Option You can also select MP-Channel ▸ Trigger Scan in the main menu or activate the Trigger scan function by clicking the MP-Channel with the right mouse button.

If more than one actuator responds at the same MP address during a bus scan or if more than one actuator is connected in PP mode, a bus jam will occur. This situation is indicated by the program with a corresponding message.




Saving a bus scan overview in a file

The result of a bus scan can be saved in a file for recording. Select "Channel" in the outline bar to show an enumeration of all found MP nodes with the corresponding data (address, position, type, description and serial number).




*Saving the bus scan overview*

Click the right mouse button to open the context menu and choose "Save to file" for saving the information in a text file.

## 3.4 Setting the bus address

Each actuator with an MP-Bus interface (valid for all devices with an MP-Bus interface, e.g. I/O modules, etc.) can be assigned an address which it will use to communicate on the MP-Bus.

The setting of the bus address can be disabled on certain actuators, e.g. for the actuator types ...LON and ...ALON (for LONWORKS®).

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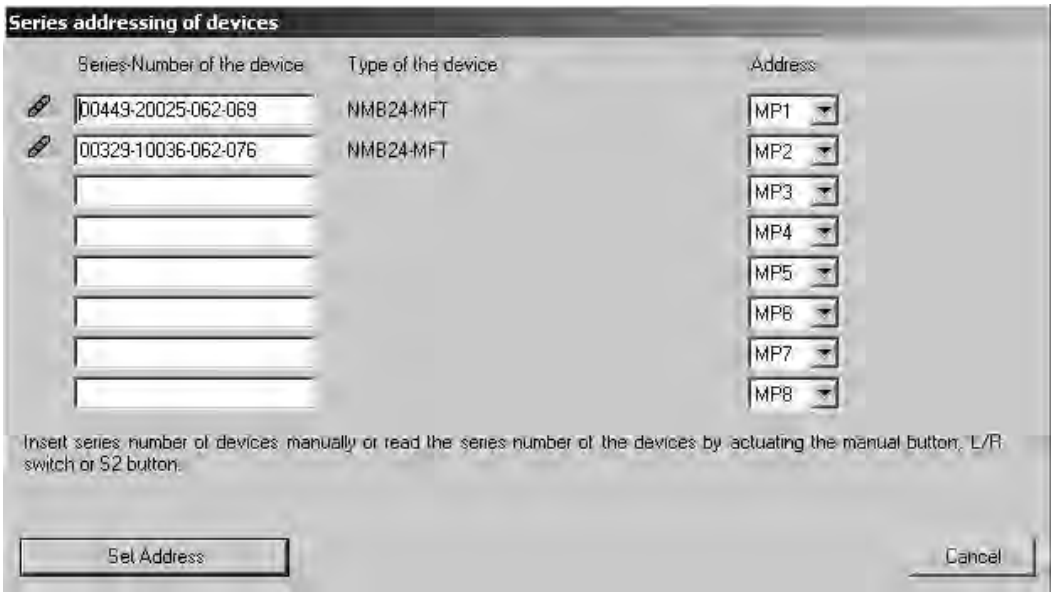
## NOTE: USE THIS SECTION ONLY IF THE ACTUATORS (S) MP ENABLED.

### 3.4.1 Series addressing of actuators

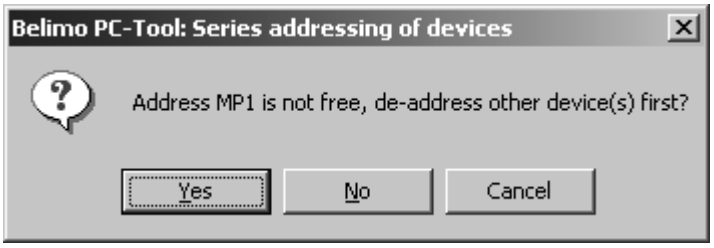
Click the Address device icon in the toolbar [B].

Option Click the MP-Channel with the right mouse button and select Addressing Device. Or select MP-Channel ▸ Addressing Device in the main menu.




*Series addressing*

If one of the addresses is already assigned to another actuator, a message will be displayed:




*Message when an address is already assigned (series addressing)*

Click Yes to initially release the address. The actuator that used to occupy the address is set to PP.

If you select No, the actuator will be set to the already assigned address and a bus jam can occur.

Click Cancel to stop the series addressing at this point. You can now rearrange the addresses or end the entire process.

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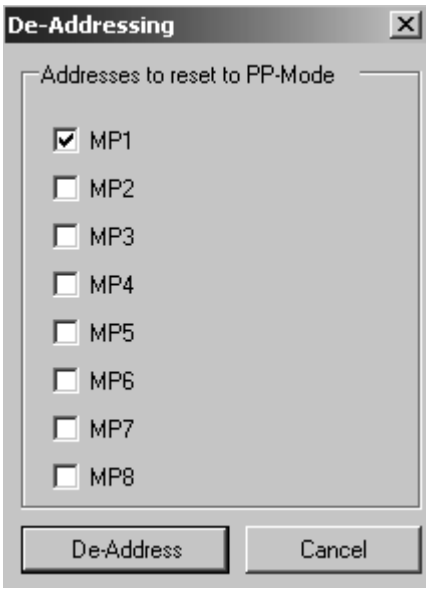
## 3.4.2 Addressing with known serial numbers

Each MP/MFT actuator is delivered with a label containing its individual serial number. These serial numbers can be used to assign a PP or an MP1 ... MP8 address to the actuator. An additional, removable label with an identical serial number is supplied with the actuator. If the actuator is installed at a particular position in the system, this additional label can be affixed at the same position in the system diagram. This records where the actuator with the corresponding serial number is located in the building. These serial numbers can be used to assign the MP1 ... MP8 addresses to the actuators.

You can also fill in the input boxes manually before clicking Set Address, for example when the buttons of the actuators are not accessible or you regularly take the serial numbers from your documents.

## 3.4.3 Resetting actuator addresses

If you want to reset actuators with MP addressing to PP, click to the right of the MP-Channel and select "De-address Device" in the pop-up menu.




*Selection of the addresses to be reset*

Mark the addresses whose actuators are to be de-addressed.

When the bus scan is set to MP/PP, the de-addressed actuators are no longer visible in the outline bar [C] as long as there are still actuators with addresses.

If you set several actuators to PP, a bus jam will occur with the bus setting "PP only".

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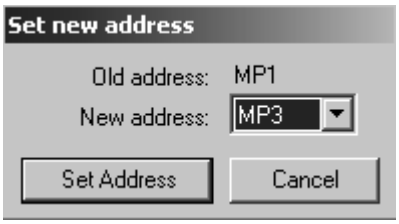
## 3.4.4 Addressing a single actuator

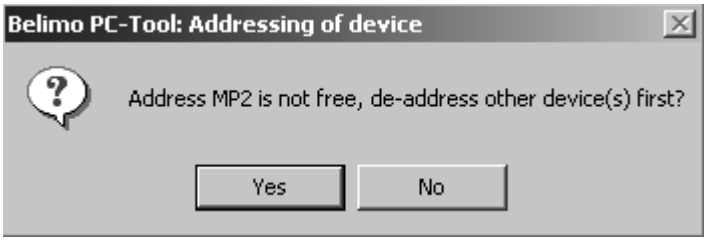
Select the actuator in the outline bar [C] and click the "Change MP Address" icon in the toolbar [B].




*Setting a new address*

Option Click the actuator with the right mouse button and select "Change MP Address" ("MP-Adresse ändern").

Select the new address in the combobox. If the address is already assigned to another actuator, a message will be displayed:




*Message when an address is already assigned*

Click Yes to initially release the address. The actuator that used to occupy the address is set to PP.

If you select No, the actuator will be set to the already assigned address and a bus jam can occur.

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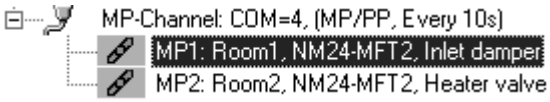
## 3.5 Selecting a module

All actuators that are active and connected to an MP-Channel are displayed in the outline bar [C]. Select the desired actuator from this display.




The type of actuator is indicated by the icon:

| Icon | Actuator type |
|---|---|
| | Damper actuator |
| | Valve actuator |
| FLS | Window ventilation actuator |
| | Actuator for fire dampers |
| | VAV (Variable Air Volume) controller actuator |
| THC | THC24-MP |
| UST | UST-3 I/O module |
| ? | Unknown actuator |

When an actuator is selected for the first time, the parameters are read out and displayed in the detail area [D].

In addition, the address for communication on the MP-Channel (MP or PP mode) and the name of the actuator type are displayed in the outline bar [C].

The complete information for identifying the selected actuator is found in the header of the detail area [D].

*Display of the actuator identification*

Note the difference between the current communication mode on the MP-Channel and the displayed address. An actuator with the address MP2 can be activated in PP mode during a bus scan, for example.

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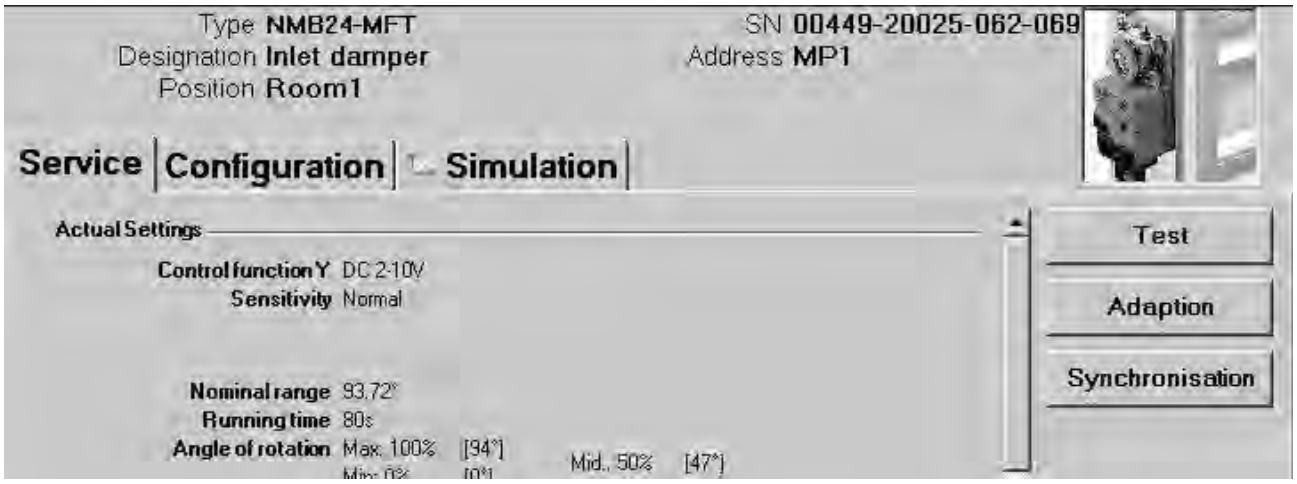
## 3.6 Actuator parameters

### 3.6.1 Displaying actuator parameters

The parameters of an actuator are displayed on the Service tab in the detail area [D].




*Example of the "Service" tab (damper actuator)*

The Test, Adaptation and Synchronization functions are described for each respective module.

### 3.6.2 Printing out actuator parameters

The displayed actuator parameters can be printed out. Click the printer icon in the toolbar [B] or select Print Actuator Parameters in the pop-up menu after clicking the actuator in the outline bar [C] with the right mouse button.

### 3.6.3 Deleting maintenance/error messages

When an actuator has created and saved maintenance or fault messages, these are displayed on the Service tab.

*Message display on the Service tab*

Use "Reset messages", to delete the messages stored in the actuator.

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Following messages may appear:

| Message | Description |
|---|---|
| Mechanical travel increased | Expected end stop value for top or bottom has been overrun. |
| Mechanical overload | Actuator did not reach set point because an obstacle has reduced the operating range |
| Excessive utilisation | Actuator moves to often compared with the total operating time<br>(typical relation of active time to operating time is greater than 25%) |

Actuators for fire & smoke dampers have provide a larger scale of messages. The specific messages are described in the Fire & Smoke module.

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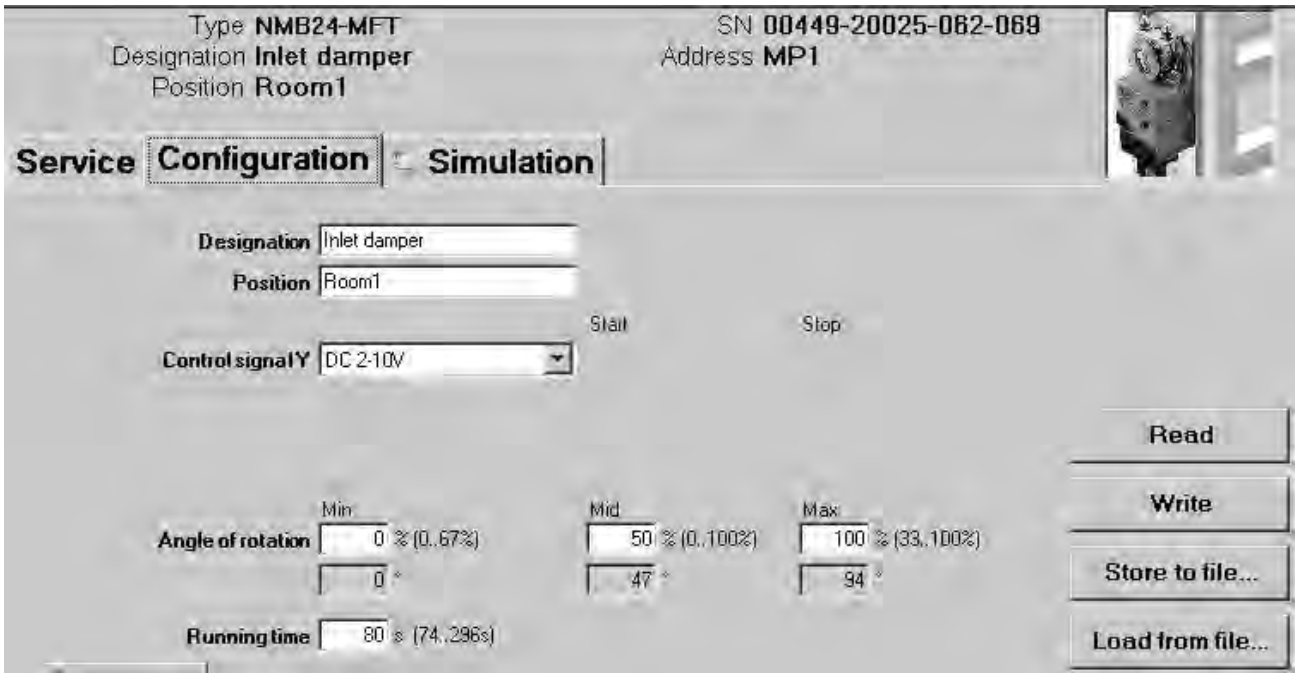
## 3.7 Configuring an actuator

To change the parameters of an actuator, go to the Configuration tab.




*Example of the "Configuration" tab (damper actuator)*

The lower area with the basic settings can be displayed with the "More..." button and hidden again with the "Less" button.

When you change a value in an input box, the box turns yellow:

The status image on the right additionally shows whether all the displayed values match those stored in the actuator:

Display matches actuator

Values have been changed

*Status image*

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Save the changed values in the actuator with the "Set" button underneath the status image. You can read out the parameters currently saved in the actuator again with the "Read" button. Entries for values that you have not previously saved in the actuator will be lost as a result.

### 3.7.1 Saving a parameter file

You can store the displayed parameters in a file (with the extension .bptpar) with "Store to file…" on the "Configuration" tab. The suggested name for the file consists of the project, the actuator type, the position, the serial number, the current date and the time of day.

Since the content of the file corresponds to the values displayed on the screen, you can change individual values and save Options in files without loading them on the actuator.

The file can only be saved when all values on the screen are valid.

### 3.7.2 Loading a parameter file

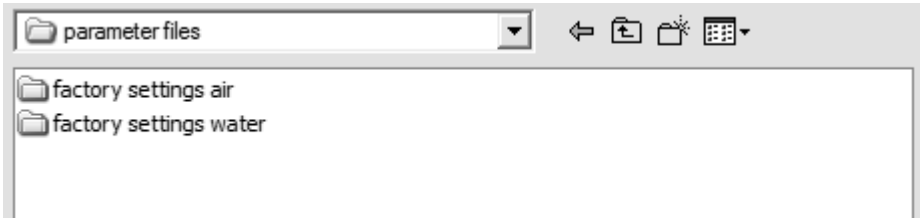
The values of a saved parameter file can be read back into the input screen for the configuration with "Load from file...".

### 3.7.3 Copying parameters

Read out the parameters of an actuator that you want to copy and save them in a file. Change the actuator, load the saved parameters from the file and program the actuator with the copied values.

### 3.7.4 Load factory settings

When a project is created, two folders are created in the parameter directory. These folders contain the factory settings for all supported actuator types.

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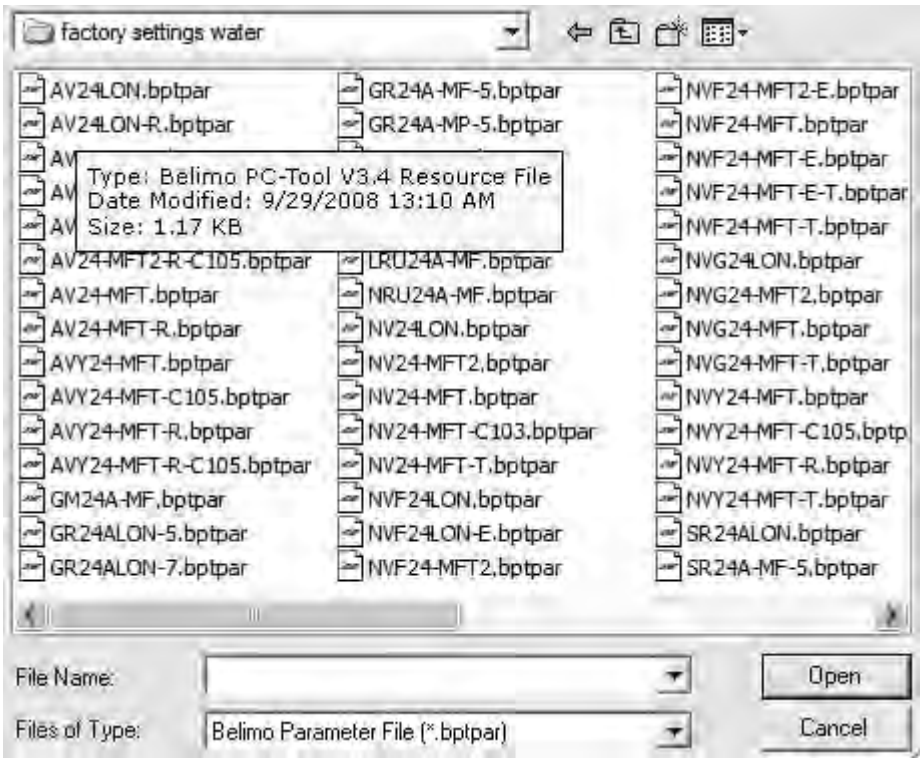


*Parameter files with factory settings*

Open the file which matches the actuator type. The settings are loaded into the input screen for the configuration. Afterwards, store the parameters in the actuator with the "Set" button.

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## NOTE: USE THIS SECTION ONLY IF THE ACTUATORS (S) MP ENABLED.

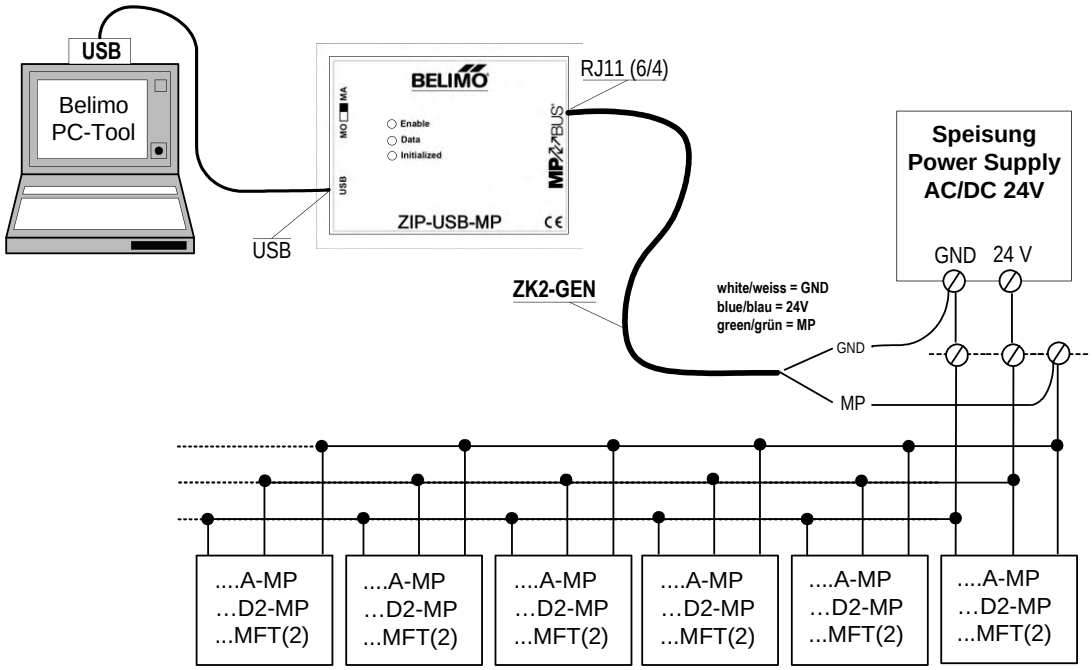
## 3.8 Parameterizing limited lots

You can parameterize several identical actuators with the function "Parameterize Limited Lots". The number depends on the power of the voltage supply.

To parameterize limited lots, save the parameter set to be programmed in a file.

With one parameter set, you can only program actuators from the same actuator family (e.g. MFT), i.e. the parameter set used must match the actuator family.

Connect the devices according to the following wiring diagram (for further wiring diagrams, see clause 4.4 Typical wiring diagrams):




Select the desired MP-Channel and click the symbol "Parameterize Limited Lots".

Option Click with the right mouse button on the MP-Channel and select Parameterize Limited Lots. Or select the MP-Channel ▸ Parameterize Limited Lots in the main menu.

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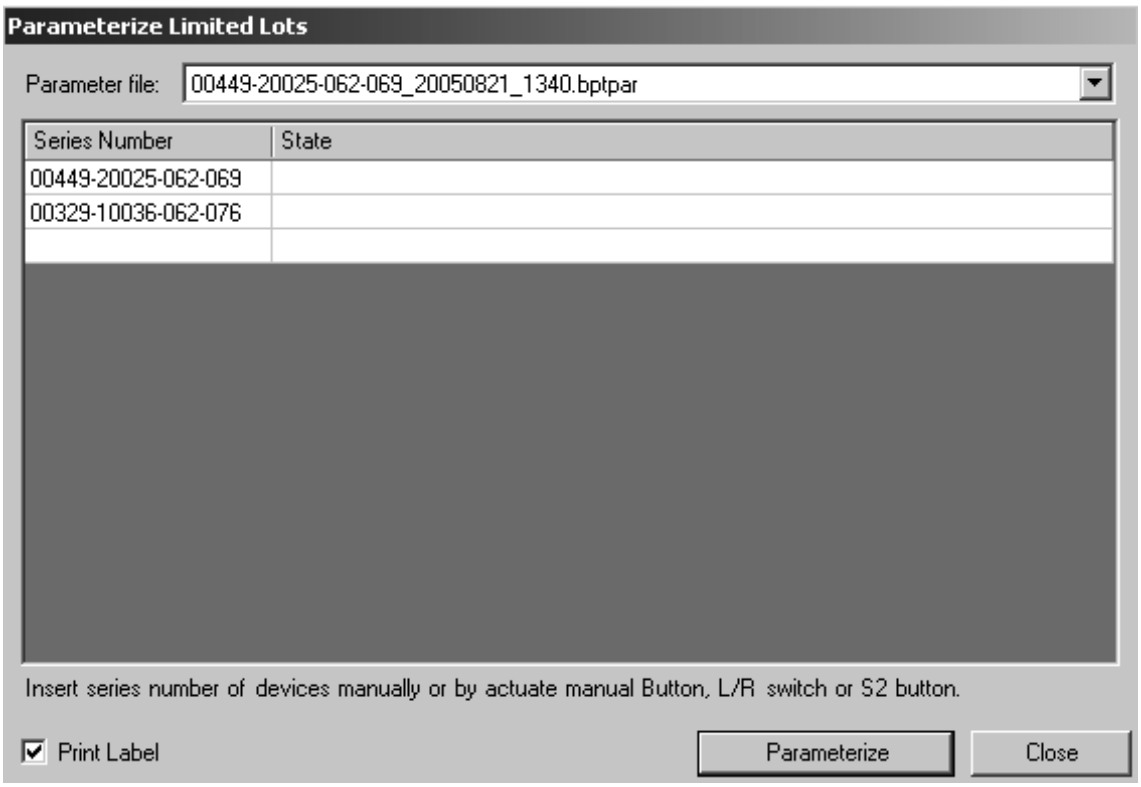


*Dialog for parameterizing limited lots*

Select the file with the saved parameters in the dialog.

Position the cursor in the first input box for the serial number. Then press the acknowledge button on the first actuator which should be parameterized. If the buttons are not accessible, directly enter the serial numbers as described below.

The serial number of the actuator is read out after the acknowledgement and written into the input box. The cursor jumps to the next line.

Repeat the process for all actuators that are to be parameterized and mark the checkbox if you want to print labels after parameterization
(see Section 3.9 "Printing labels").

Click Parameterize.

The PC-Tool now asks for the file with the values to be written into the actuators.

---

The periodic bus scan is stopped for the duration of the parameterization. The actuators are successively set to the address MP1, programmed and finally set to PP addressing.

When the bus scan is set to MP/PP, the actuators in the outline bar [C] will not be visible. If the bus setting PP only is used, a bus jam will result.

---

If an error occurs during programming, a corresponding text is displayed in the "State" column.

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If the address MP1 is already assigned to an actuator, a message will be displayed:

*Message when the address MP1 is already assigned (limited lot)*

Click OK to initially release the address MP1. The actuator that used to be assigned to this address will be set to PP.

Click Cancel to stop the parameterization at this point.

Identification with known serial numbers

You can also fill in the input boxes manually before you click "Parameterize", for example when the buttons of the actuator are not accessible or you regularly take the serial numbers from your documents.

Programming further series

The actuators that have been successfully programmed are deleted from the list. You can register further serial numbers in the list and then click "Start parameterization" again.

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## 3.9 Printing labels

To identify actuators, you can write self-adhesive labels with the PC-Tool program. A special printer may be necessary, depending on the type of label.

### 3.9.1 Setting up a configuration file

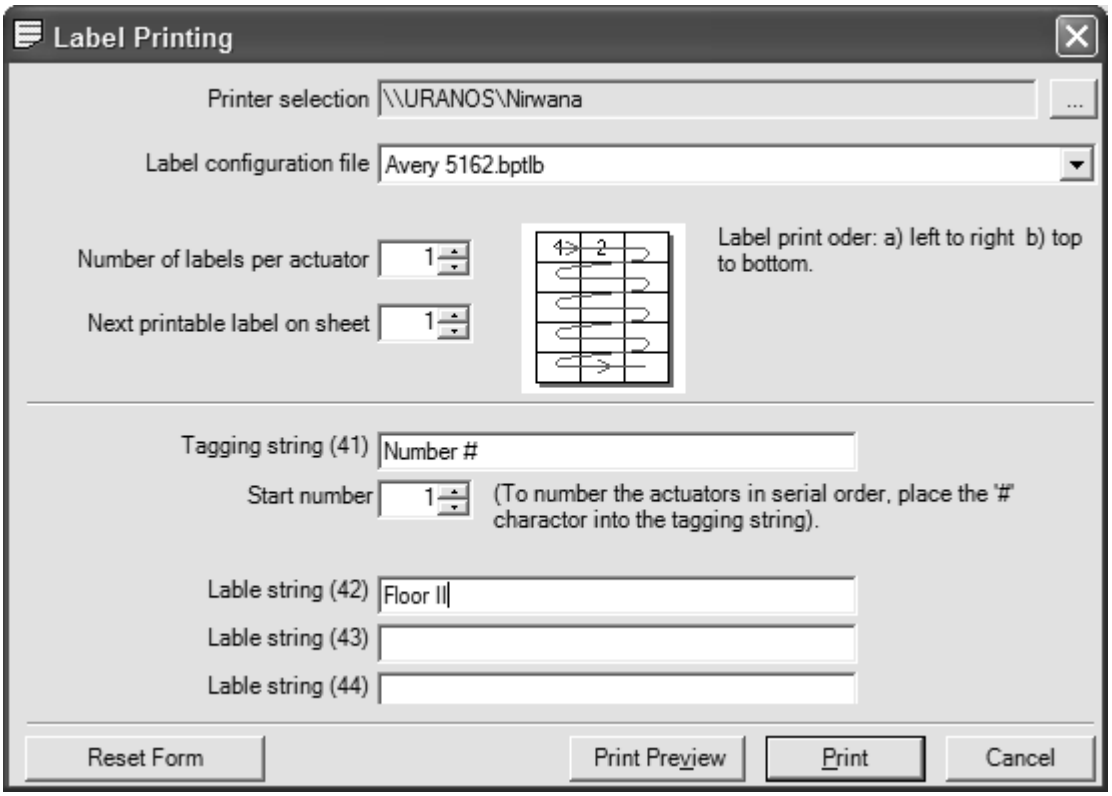
Labels are defined per project. To print labels, set place holders (number in brackets) in the configuration file for the information to be printed.

The structure and storage location of the configuration files are described in the Appendix.

### 3.9.2 Printing labels

Select an actuator and click the "Print Label" icon (with an orange background).

Option Click an actuator in the outline bar [C] with the right mouse button and select "Label Printing".




*Label printing dialog*

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Select a printer and a configuration file.

Enter the number of identical labels that are to be printed for "Number of labels per actuator". When parameterizing limited lots, the total number of printed labels is equal to this value times the number of actuators.

Enter the desired texts {41} – {44} that are to be printed, if necessary. A maximum of 50 characters are available per text box. In text with consecutive numbering, a number is entered instead of the place holder "#". This number is increased by one for each new actuator.

If labels have already been used from a label sheet, you can specify at what label position the printing should start (for example 4 when 3 labels have been used from the first row).

Your entries and the selected printer are preserved from one label printing process to the next (automatic saving). You can empty the input boxes with Reset Form.

The texts {41} – {44} must be present in the label configuration file in the form of place holders. Otherwise, they will not be printed out.

### 3.9.3 Printing labels offline

Labels can still be printed even if no actuator is connected. In this case, only the information from the project data, the texts entered in the dialog and the current date can be output. The start number is always used instead of the place holder #.

Click the "Print label" icon (with gray background).

Option Click the project in the outline bar [C] with the right mouse button and select "Label Printing". Or select Project ▸ Print Label in the main menu.

For Number of labels per actuator, enter the number of identical labels to be printed. The number with the placeholder "#" is NOT counted up. The further procedure is the same for printing actuator labels.

## NOTE: USE THIS SECTION ONLY IF THE ACTUATORS (S) MP ENABLED.

## 3.10 Transformation tables

Transformation tables are for converting the sensor value into another physical quantity, for example from resistance (in ohms) to temperature (in °C) for NTC resistors. Several frequently used transformation tables are supplied with the program.

Selecting a transformation table

Select a transformation table with the combobox. The corresponding converted value is displayed underneath the sensor value.

The measured sensor variable in the table must match the selected sensor type: volts for active sensors, ohms for sensor resistors, on/off for switches.

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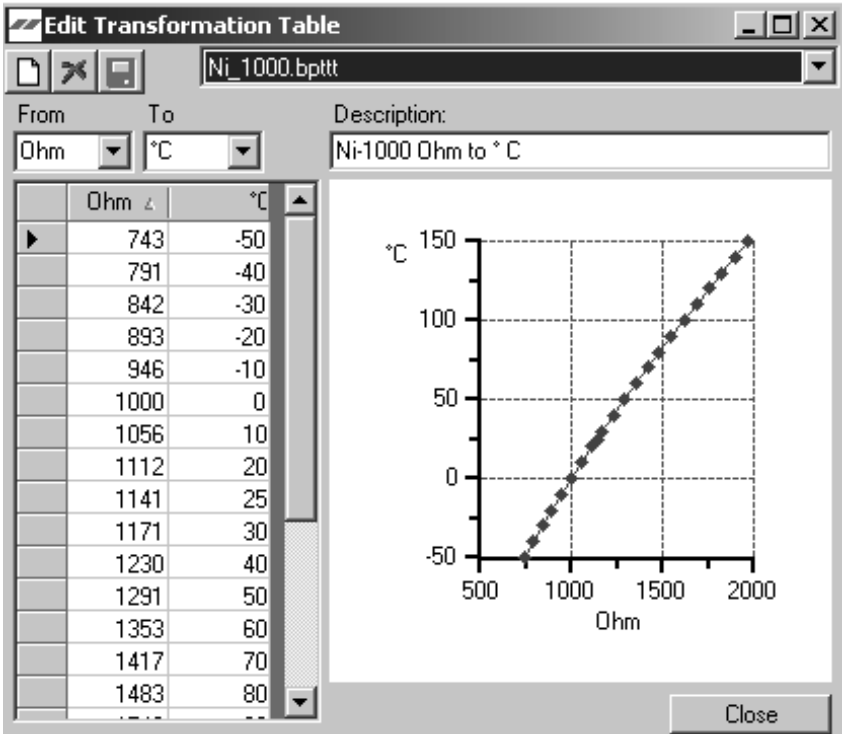
Adapting a transformation table

Click the transformation table icon.

Option Click the project in the outline bar [C] with the right mouse button and select Transformation table. Or select Project ▸Transformation table in the main menu.




*Dialog for editing transformation tables*

Select an available transformation table using the combobox.

The sensor values and the converted values are displayed in the table on the left. On the right, you see a corresponding diagram with the sensor values on the horizontal axis and the converted values on the vertical axis. The table values are *linearly interpolated*; in other words, the points are connected by straight lines to calculate intermediate values.

During conversion, the first and last connection lines are extended beyond the range of entered points (*extrapolated*) so that even sensor values outside of this range are valid.

You can adapt each value in the table or add new value pairs in the last line, which is marked with an asterisk (*). Newly added value pairs are automatically sorted into the right place.

The following holds true for switches: Off = 0, On = 1.

Save the changes to the transformation table by clicking on the floppy disk icon.

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When you change a transformation table in one project, the changes do not affect corresponding tables in other projects. However, you can return to the original project folder from all projects through the entry <Other...> in the combobox and open the changed table.

Setting up a new transformation table

When the dialog for editing a transformation table is open, you can create a new table with the "New" icon. Select the physical quantities for the sensor values and the converted values in the comboboxes above the table. You can also write any other quantities into the text boxes of the comboboxes.

For the sensor values, only volts, ohms and on/off are meaningful input quantities, because only these sensor types are supported.

Enter a description in the text box and add new value pairs in the last line of each table, which is marked with an asterisk (*). A transformation table must have at least two lines.

For switches, you can define an on/off inversion table with the assignments 0 → 1 and 1 → 0.

Save the new transformation table by clicking on the floppy disk icon. The name that you enter in the "Save file as" dialog will be subsequently offered as a selection in the combobox.

If the name of the new table does not appear in the combobox on the "Simulation" tab, open the project again.

The new transformation table is not directly available as a selection in the combobox in other projects. However, you can return to the original project folder from all projects through the entry <Other...> in the combobox and open the new table.

Deleting a transformation table

When the dialog for editing a transformation table is open, you can use the Delete icon to delete a table that has been selected in the combobox.

If the name of the deleted table still appears on the "Simulation" tab in the combobox, open the project again.

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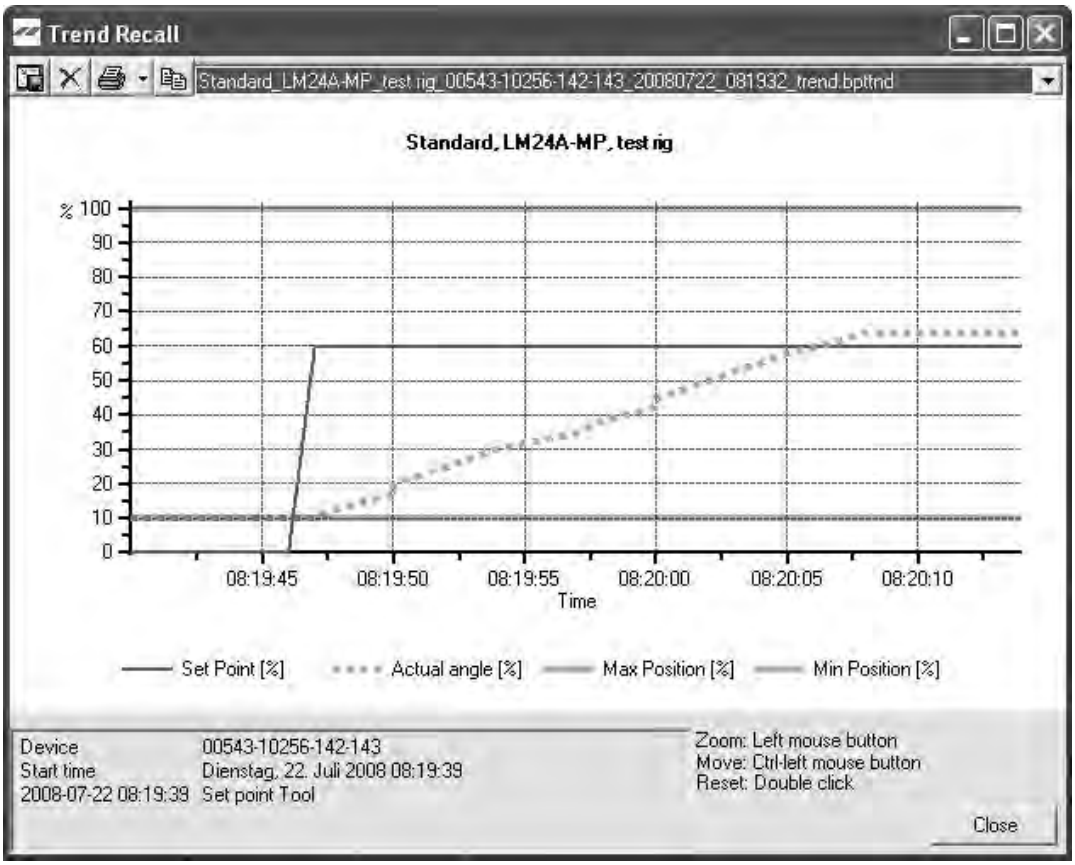
## 3.11 Displaying recorded trend data

Click the symbol Trend display.

Option Click the project in the outline bar [C] with the right mouse button and select "Trend Recall". Or select Project ▸ Trend Recall in the main menu.




*Trend recall*

Select a trend file with the combobox.

Keep the CTRL key pressed and pull the diagram to the left or right with the mouse in order to display values for other times.

You can use the copy button to insert the diagram into other documents via the clipboard.

Use the save button to fix the window size of the trend display.

Printing a trend

Click the Print icon or press the key combination CTRL-P.

Option In addition to the Print button, you can open a menu with the "down" key. In addition to printing, this allows you to display a preview or select several files for printing with "Print multiple".

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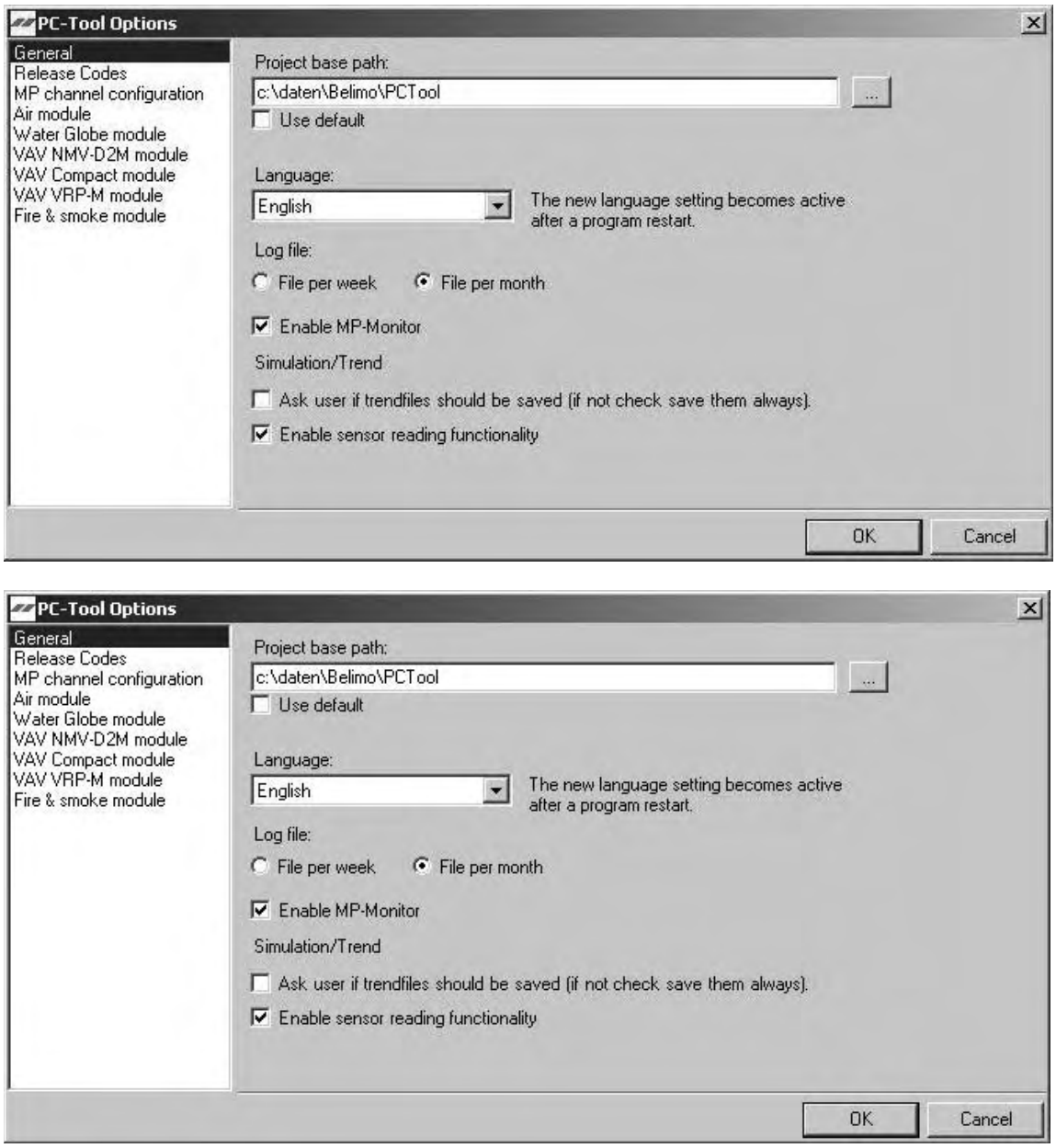
## 3.12 PC-Tool options

Select Tools▸PC-Tool options... in the main menu.

Option Click the project in the outline bar [C] with the right mouse button and select PC-Tool options...




*Dialog for basic settings (general)*

"Project base path" sets the default directory in the file system, in which the new project folder will be saved. You can override this information when creating new projects, however.

When you mark the "Use default", checkbox, new projects will be saved in your user profile under "My Documents". With the operating system Microsoft Windows XP (English), this folder is located under

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C:\Documents and Settings\<Name>\My Documents.

You can open the folder "My Documents" with the "My Computer" icon.

The language that you select in the combobox will be used the next time that you start the program.

Under "Log file", you can define whether a separate log file should be created each month or each week.

Mark the "Activate MP-Monitor" checkbox to monitor the communication with the actuators with the diagnostic tool.

In addition to "General", the names of the supported modules (actuator families) are displayed on the left side. Further information on the module-specific settings is found in the corresponding sections of this manual.

## 3.13 Log file

All activities with the PC-Tool software that influence the data stored in the actuator are recorded in a separate log file for every project. The time of each action is logged.

Configuring the log file

You can create a separate log file for each week or month of a project (default: File per month). To change this setting, select Tools▸PC-Tool options in the main menu. You can select either ‘File per week' or ‘File per month' under ‘General'.

Reading the log file

Click the "Read log file" icon in the toolbar.

Options

Click the project icon in the outline bar [C] with the right mouse button and select Read log file. Or select Project ▸Read log file in the main menu.

Using the combo box ‘Log file', you determine the file to read. The contents of the log file are displayed in a table in the top section (each action starts a new row).

By clicking a column title, you can sort the table according to the selected column. By clicking again on the same column title, the sorting direction is reversed: increasing (A-Z) or decreasing (Z-A).

Details

Click a table row to display details of this action in the bottom section.

You can print the text in the detail area ("Print…" button) or copy it to the clipboard ("Copy" button) and then paste it into another document.

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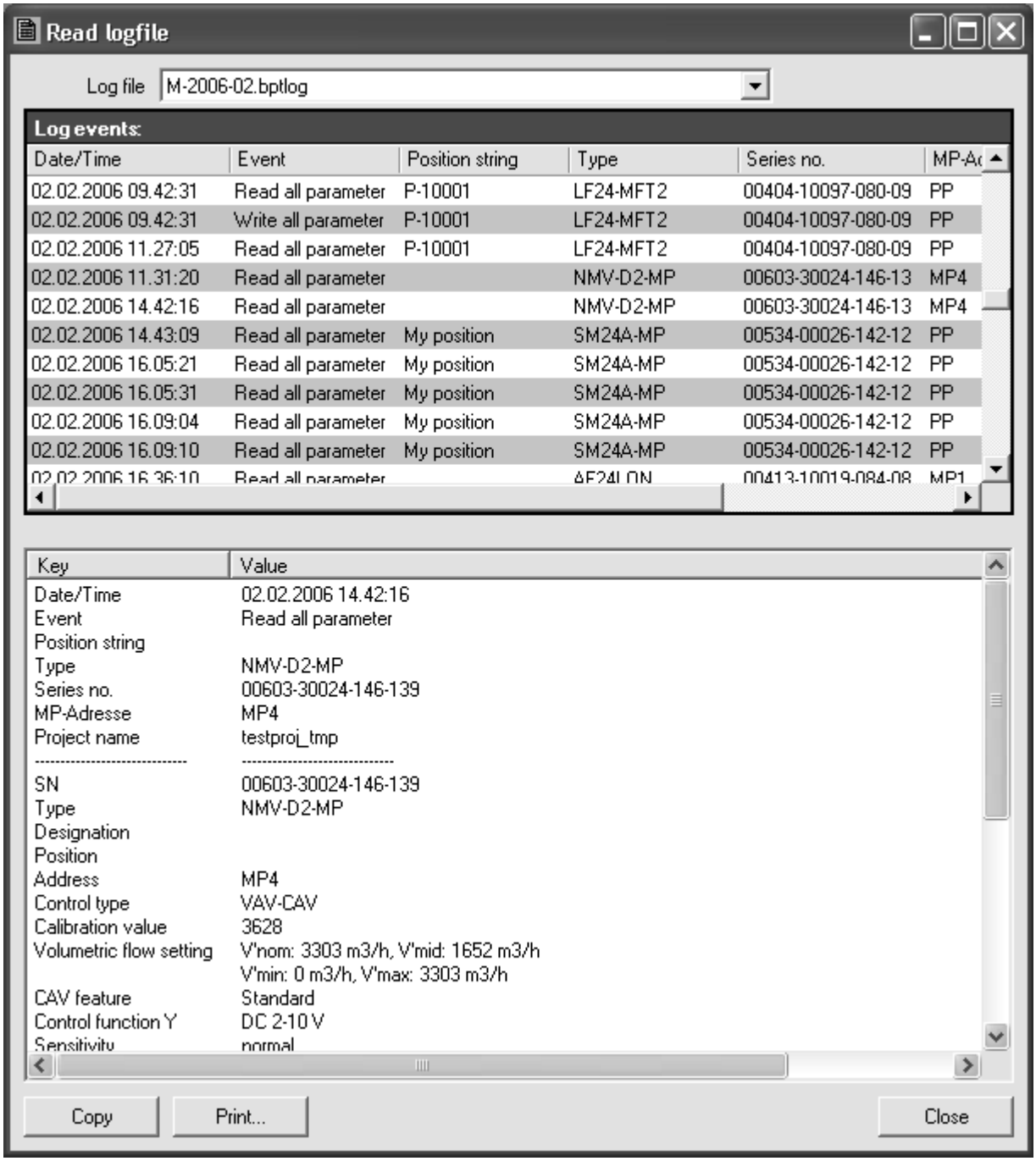
Read logfile
Log file
M-2006-02.bptlog
Log events:
Date/Time
Event
Position string
Type
Series no.
MP-Ac
02.02.2006 09.42:31 Read all parameter P-10001 LF24-MFT2 00404-10097-080-09 PP
02.02.2006 09.42:31 Write all parameter P-10001 LF24-MFT2 00404-10097-080-09 PP
02.02.2006 11.27:05 Read all parameter P-10001 LF24-MFT2 00404-10097-080-09 PP
02.02.2006 11.31:20 Read all parameter NMV-D2-MP 00603-30024-146-13 MP4
02.02.2006 14.42:16 Read all parameter NMV-D2-MP 00603-30024-146-13 MP4
02.02.2006 14.43:09 Read all parameter My position SM24A-MP 00534-00026-142-12 PP
02.02.2006 16.05:21 Read all parameter My position SM24A-MP 00534-00026-142-12 PP
02.02.2006 16.05:31 Read all parameter My position SM24A-MP 00534-00026-142-12 PP
02.02.2006 16.09:04 Read all parameter My position SM24A-MP 00534-00026-142-12 PP
02.02.2006 16.09:10 Read all parameter My position SM24A-MP 00534-00026-142-12 PP
Key
Value
Date/Time 02.02.2006 14.42:16
Event Read all parameter
Position string
Type NMV-D2-MP
Series no. 00603-30024-146-139
MP-Adresse MP4
Project name testproj_tmp
SN 00603-30024-146-139
Type NMV-D2-MP
Designation
Position
Address MP4
Control type VAV-CAV
Calibration value 3628
Volumetric flow setting V'nom: 3303 m3/h, V'mid: 1652 m3/h
V'min: 0 m3/h, V'max: 3303 m3/h
CAV feature Standard
Control function Y DC 2-10 V
Copy
Print...
Close

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# 4 Attachment

## 4.1 Storage locations of files

### 4.1.1 Project data

The default project is stored as a "Default project" sub-directory in the installation directory of the program.

The projects are user-specific and are stored as a sub-directory in the user profile. For an English-language version of Windows, this is

```
C:\Documents and Settings\<Name>\My Documents\Belimo\PCTool
```

This directory contains sub-directories with the project names.

### 4.1.2 Configuration files

The user-specific settings are stored in the user profile under "Application data". For an English-language version of Windows, this is

```
C:\Documents and Settings\<Name>\Application Data\Belimo\PCTool
```

This directory can be "hidden" under Windows. If it is not present, the settings will be queried upon starting.

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## 4.2 Configuration files for printing labels

### 4.2.1 Storage location

The filenames have the extension *.bptlb. They are saved in the "label definition" directory for each project. For an English-language version of Windows, this is

```
C:\Documents and Settings\<Name>\My Documents\Belimo\PCTool\ <Project>\label definition
```

### 4.2.2 Format

The configuration files for label printing are stored in XML format. You can edit these files with an editor program, for example "Notepad".

Configuration files for common Avery and Zweckform labels are supplied with the program.

Example of a configuration file

```
<?xml version="1.0" encoding="utf-8"?>
<LabelDefinition xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <PageSize Height="278" Width="214" />
  <PageBorder Top="18" Left="5" />
  <LabelSize Height="33" Width="100" />
  <LabelBorder Top="5" Left="5" />
  <Lines>
    <Line Text="" />
    <Line Text="{0} / {1}" />
    <Line Text="{20}" />    <Line Text="{21}" />
    <Line Text="{23}" />
    <Line Text="{41} / {42}" />
  </Lines>
</LabelDefinition>
```

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### 4.2.3 Boxes

You can adapt the values for the page layout (values in millimeters) for new label formats.

| **PageSize** | **Page size (height and width)** |
|---|---|
| PageBorder | Border width (top and left) = distance from the top left corner of the first label to the page border |
| LabelSize | Size of an individual label |
| LabelBorder | Label border width (top and left) = distance of the lettering from the label border |

In every line element <Line>, you can insert place holders where certain project and actuator characteristics will be added during printing.

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| | |
|---|---|
| {0} | Company name (from project data) |
| {1} | Project name |
| {10} | Actuator type |
| {11} | OEM designation |
| {12} | Position |
| {13} | Serial number |
| {14} | MP address |
| {20} | Control type Y |
| {21} | Feedback signal U5 |
| {22} | Range of rotation min – mid – max |
| {23} | Running time |
| {24} | Direction of rotation (cw /ccw) |
| {25} | Bus fail position |
| {26} | Sensitivity |
| {27} | Synchronization at |
| {28} | Torque |
| {29} | Nominal range |
| {30} | Conductance |
| {31} | Vnom |
| {32} | Vmax |
| {34} | Vmin |
| {36} | Control fct. |
| {37} | Mode |
| {40} | Printing date |
| {41} | Text with consecutive numbering |
| {42} | Freely definable text 1 |
| {43} | Freely definable text 2 |
| {44} | Freely definable text 3 |
| {50} | Switching point S1 in degrees (°) |
| {51} | Switching point S2 in degrees (°) |
| {52} | Setting damper free running test |

You can define up to 50 lines. The program does not check whether the lines fit on a label.

When you define a new configuration file in a project, this configuration will not be directly available in other projects. However, you can return to the original project folder from all projects by using the entry <Other...> in the combobox, and then use the file.

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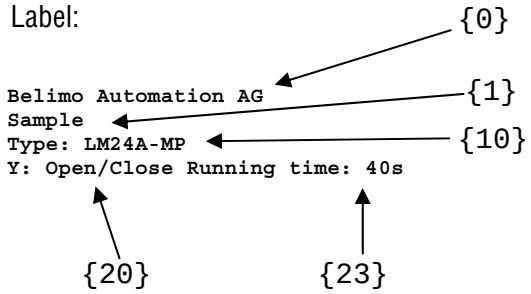
### 4.2.4 Example of a label

The following example results in a label having the dimensions width x height = 50 mm x 20 mm. The example is intended for an endless label printer that prints labels of the size 50 mm x 20 mm.

The company name, the project name, the actuator type, the type of control signal and the running time are printed on the label.

This data yields the following configuration file and the subsequently displayed label:

```
<?xml version="1.0" encoding="utf-8"?>
<LabelDefinition xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <PageSize Height="20" Width="50" />
  <PageBorder Top="0" Left="0" />
  <LabelSize Height="20" Width="50" />
  <LabelBorder Top="5" Left="5" />
  <Lines>
    <Line Text="{0}" />
    <Line Text="{1}" />
    <Line Text="Type: {10}"/>
    <Line Text="{20} Running time: {23}"/>
  </Lines>
</LabelDefinition>
```

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## 4.3 Troubleshooting and error messages

### 4.3.1 General

Problem After the program starts, an MP-Channel is not opened but displayed with the MP-Channel icon.

Solution The MP-Channel cannot be opened, for example because the selected serial interface is assigned to another application. Check whether a modem or a communication program is using this interface.

### 4.3.2 Error messages

| **Error message** | **Description** |
|---|---|
| Start adaptation failed. | Communication failure on the MP-Channel or faulty actuator. |
| Actuator locked for PC-Tool. | The drive has been configured so that it can be neither read out nor programmed with the PC-Tool. |
| Summary: Actuator not reachable | Communication failure on the MP-Channel or faulty actuator. |
| Summary: Actuator run into timeout. | The drive did not respond within the specified time. |
| Answer has too much data. | Conflict between the actuator and program. The program library (belipp.dll) may not be up-to-date. |
| Answer doesn't have enough data. | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. |
| Command has not enough parameters. | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. |
| Command parameters out of range. | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. |
| Belimo library error code = …. | Internal fault. |
| Description is missing | A transformation table must have a description. |
| Bus Jam | Two or more devices respond to the same address. Re-address the actuators. |
| This field is required! | This field must have an entry. It is not allowed to remain empty. |
| There is already an instance running! | The program cannot be started on a computer where it is already running. |
| Error while creating the project! | Check whether it is possible to write to the storage location of the project. |
| Error while copying default project. | When a new project is created, configuration files and sub-directories are normally copied from the default project in the installation directory of PC-Tool. The default project has probably been accidentally deleted, moved or renamed. |

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| Error message | Description |
|---|---|
| Default project directory '…' does not exist! Please reinstall the application. | When a new project is created, configuration files and sub-directories are normally copied from the default project in the installation directory of PC-Tool. The default project has probably been accidentally deleted, moved or renamed. |
| Command ... unknown by the device | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. |
| The value must be between … and …. | The entry is not in the permitted range of values. |
| Invalid data answer from the device. | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. |
| The difference is smaller than …. | A rule for the minimum difference between two values has been violated. |
| The length of the string must not exceed … characters. | Shorten your entry. |
| MP-command ... unknown by PP_Function | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. |
| A transformation table must have at least 2 points. | A transformation table must have at least 2 lines to be able to calculate intermediate values. |
| Not all parameters written to device | (Note the detailed instructions with the message regarding the reason for the error.) |
| Label print failed. | (Note the detailed instructions with the message regarding the reason for the error.) |
| Wrong device family … instead of … | When setting the parameters of small batches, an actuator from another actuator family was connected and does not match the parameter file. |
| Wrong transformation table for this sensor type. It cannot transform from unit …. | The transformation table does not have the measuring quantity of the sensor in the first column. Resistance sensors must convert 'ohm' into the target parameter, for example. |
| Wrong device connected! | This fault occurs when actuators are changed during parameterization. Read the parameters out again. |
| Wrong MP channel: '...'. | The MP-Channel has changed. |

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| Error message | Description |
|---|---|
| Error starting testscript | The test script is invalid. |
| Label printing error | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error loading transformation table | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error while loading project file: … | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error reading parameter file | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error opening Channel …. | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error opening file explorer | File Explorer could not be started when displaying MP-Monitor files. |
| Error opening MP-Monitor | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error while saving test report! | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error while processing line … of the trend file … | The trend file could not be interpreted. It was probably written manually. |
| Error: Invalid code for the module release. | Relates to the entry of the activation code. Please check your entry. All boxes must be filled-out according to the requirements. |
| Error: There is another device on MP1 | Address conflict. |
| Error: Unable to change address to MP1 | Address conflict. |
| Error: no answer from actuator | Communication failure on the MP-Channel or faulty actuator. |
| Address ... already set to this device! | Re-addressing re-assigns an already existing address. |
| Module release code expired! | Please contact your representative for a replacement of the code. |
| Character '…' is not allowed (not ISO-8859-1)! | Only characters from the Western European character set are permitted for Description and Position of an actuator (see table in Section 4.3.3). |
| No answer (possible bus jam). | Communication problem on the MP-Channel or faulty actuator. |
| No answer from device. | Communication failure on the MP-Channel or faulty actuator. |
| No label configuration file chosen. | Please choose a valid label configuration file and print a test label or uncheck print label after write. |
| No or empty setup string. | "Other" was selected when setting the communication parameters, but no connection was specified. |
| Could not deaddress other device | Address problem. (Note the detailed instructions with the message regarding the reason for the error.) |
| Couldn't write to the device! | Communication failure on the MP-Channel or faulty actuator. |

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| Error message | Description |
|---|---|
| Could not find the VRP-M Tool executable. Would you search for it now? | Concerns VRP-M controller. The corresponding program could not be found at the location specified in the PC-Tool options.<br>Configure the path in the options (menu Tools/PC-Tool options in VRP-M). |
| Could not find PC-Tool V2.1. Would you search for it now? | Affects VAV actuators. The old version of the program could not be found at the location specified in the PC-Tool options. |
| Error while loading project. | (Note the detailed instructions with the message regarding the reason for the error.) |
| MP-Command ... failed. | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. MP command could be password-protected. |
| MP-Channel was closed | The MP-Channel was closed during an asynchronously running function. |
| Not all data written to the device. | Communication problem during writing of the parameter data, possibly due to bus jam. Check the connection and addressing of the actuators. An MP command is password-protected or the actuator is not familiar with the command. |
| Could not read all data from the device. | Communication problem while the parameter data was read, possibly due to bus jam. Check the connection and addressing of the actuators. |
| Not all fields have valid values! Can't write data | One or more input values in the "Configuration" tab is not valid. Look for a flashing exclamation mark. If you move the mouse pointer to the exclamation mark, an explanatory text (tooltip) with the valid range of values will usually appear. |
| OEM or BELIMO password necessary. Please contact OEM-Manufacturer | Parameters on the actuator can be protected with a password against changes. A password is necessary to overwrite them. |
| Parameter file contains no series number | When setting the parameters of small batches, the actuator family is checked by means of the serial number. The parameter file is old or has been changed manually. |
| Error opening configuration file | (Note the detailed instructions with the message regarding the reason for the error.) |
| Error storing configuration file | (Note the detailed instructions with the message regarding the reason for the error.) |
| Plausibility check: Failed. Please check the configuration dialog for further information. | Testing is not started if there are errors in the configuration. |
| Problems opening the MP-Channel "...". | Error at the interface. Check the communication parameters and the cabling. |
| Sending ... to ... returned error ... | Conflict between actuator and program. The program library (belipp.dll) may not be up-to-date. |
| Wrong format of serial number | You have made a typing error while manually entering the serial number. Check the notation of the serial number. |

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| Error message | Description |
|---|---|
| Series number has a wrong format! | You have made a typing error while manually entering the serial number. Check the notation of the serial number. |
| Reset alarm messages failed | Communication failure on the MP-Channel or faulty actuator. |
| Synchronization failed | Communication failure on the MP-Channel or faulty actuator. |
| The test script cannot be started because some conditions are not complied. | A certain minimum air flow or system pressure is necessary for the test. Please check fan and VAV box. |
| Start test run failed | Communication failure on the MP-Channel or faulty actuator. |
| New address could not be verified | The serial number is read before and after an actuator is re-addressed. These two numbers do not match. Another actuator probably answers to the programmed address. |
| Unknown MP-Channel '...'. | The MP-Channel could not be identified. |
| Invalid or corrupted parameter file '...' | The contents of the file could not be correctly interpreted. The format may no longer be valid. If possible, read out the parameters again and save them in a new file. |
| Invalid Series Number | The entered serial number was not found in any connected actuator. |
| Invalid value entered | Refer to the notes about the valid range of values. |
| Invalid value! | Refer to the notes about the valid range of values. |
| Unspecific Belimo-Lib error | Internal fault. |
| Must be greater than zero. | Refer to the notes about the valid range of values. |
| Must be an integer. | Refer to the notes about the valid range of values. |
| Summary: Test cannot be executed due to active forced control | Remove the Y connection with the control signal for the duration of the test. |
| Two or more devices respond to the same address. | Bus jam Re-address the actuators. |

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## 4.3.3 ISO 8859-1/ANSI character set

Only characters from the ISO 8859-1/ANSI character set are permitted in the "Description" and "Position" box

| Pos | Char | Pos | Char | Pos | Char | Pos | Char | Pos | Char | Pos | Char | Pos | Char |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | | 64 | @ | 96 | ` | 128 | € | 160 | [7] | 192 | À | 224 | à |
| 33 | ! | 65 | A | 97 | a | 129 | • | 161 | ¡ | 193 | Á | 225 | á |
| 34 | " | 66 | B | 98 | b | 130 | ‚ [1] | 162 | ¢ | 194 | Â | 226 | â |
| 35 | # | 67 | C | 99 | c | 131 | *f* | 163 | £ | 195 | Ã | 227 | ã |
| 36 | $ | 68 | D | 100 | d | 132 | „ [2] | 164 | ¤ | 196 | Ä | 228 | ä |
| 37 | % | 69 | E | 101 | e | 133 | … | 165 | ¥ | 197 | Å | 229 | å |
| 38 | & | 70 | F | 102 | f | 134 | † | 166 | ¦ | 198 | Æ | 230 | æ |
| 39 | ' | 71 | G | 103 | g | 135 | ‡ | 167 | § | 199 | Ç | 231 | ç |
| 40 | ( | 72 | H | 104 | h | 136 | ˆ | 168 | ¨ | 200 | È | 232 | è |
| 41 | ) | 73 | I | 105 | i | 137 | ‰ | 169 | © | 201 | É | 233 | é |
| 42 | * | 74 | J | 106 | j | 138 | Š | 170 | ª | 202 | Ê | 234 | ê |
| 43 | + | 75 | K | 107 | k | 139 | ‹ | 171 | « | 203 | Ë | 235 | ë |
| 44 | , | 76 | L | 108 | l | 140 | Œ | 172 | ¬ | 204 | Ì | 236 | ì |
| 45 | - | 77 | M | 109 | m | 141 | • | 173 | - [8] | 205 | Í | 237 | í |
| 46 | . | 78 | N | 110 | n | 142 | Ž | 174 | ® | 206 | Î | 238 | î |
| 47 | / | 79 | O | 111 | o | 143 | • | 175 | ¯ | 207 | Ï | 239 | ï |
| 48 | 0 | 80 | P | 112 | p | 144 | • | 176 | ° | 208 | Ð | 240 | ð |
| 49 | 1 | 81 | Q | 113 | q | 145 | ‘ [3] | 177 | ± | 209 | Ñ | 241 | ñ |
| 50 | 2 | 82 | R | 114 | r | 146 | ' [4] | 178 | ² | 210 | Ò | 242 | ò |
| 51 | 3 | 83 | S | 115 | s | 147 | " [5] | 179 | ³ | 211 | Ó | 243 | ó |
| 52 | 4 | 84 | T | 116 | t | 148 | " [6] | 180 | ´ | 212 | Ô | 244 | ô |
| 53 | 5 | 85 | U | 117 | u | 149 | • | 181 | µ | 213 | Õ | 245 | õ |
| 54 | 6 | 86 | V | 118 | v | 150 | – | 182 | ¶ | 214 | Ö | 246 | ö |
| 55 | 7 | 87 | W | 119 | w | 151 | — | 183 | · | 215 | × | 247 | ÷ |
| 56 | 8 | 88 | X | 120 | x | 152 | ˜ | 184 | ¸ | 216 | Ø | 248 | ø |
| 57 | 9 | 89 | Y | 121 | y | 153 | ™ | 185 | ¹ | 217 | Ù | 249 | ù |
| 58 | : | 90 | Z | 122 | z | 154 | š | 186 | º | 218 | Ú | 250 | ú |
| 59 | ; | 91 | [ | 123 | { | 155 | › | 187 | » | 219 | Û | 251 | û |
| 60 | < | 92 | \ | 124 | \| | 156 | œ | 188 | ¼ | 220 | Ü | 252 | ü |
| 61 | = | 93 | ] | 125 | } | 157 | • | 189 | ½ | 221 | Ý | 253 | ý |
| 62 | > | 94 | ^ | 126 | ~ | 158 | ž | 190 | ¾ | 222 | Þ | 254 | þ |
| 63 | ? | 95 | _ | 127 | | 159 | Ÿ | 191 | ¿ | 223 | ß | 255 | ÿ |

The character positions marked with • are vacant.

1) Single speech mark, low
2) Double speech marks, low
3) Single left speech mark
4) Single right speech mark
5) Double left speech marks
6) Double right speech marks
7) Non-breaking space
8) Breaking hyphen

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## 4.4 Typical wiring diagrams

### 4.4.1 Overview table

| Cable | MP level converters and devices | Drawing | Page |
|---|---|---|---|
| **ZK1-GEN** | **ZIP-USB-MP** | Typical wiring diagram 1 | 1-55 |
| **ZK2-GEN** | **ZIP-USB-MP** | Typical wiring diagram 2 | 1-55 |
| | | Typical wiring diagram 3 | 1-56 |
| **ZK6-GEN** | **ZIP-USB-MP** | Typical wiring diagram 4 | 1-56 |
| **ZKS-MP** | **ZIP-USB-MP** | Typical wiring diagram 5 | 1-57 |
| **ZK1-VAV** | **ZIP-USB-MP** | Typical wiring diagram 6 | 1-57 |
| | | Typical wiring diagram 7 | 1-58 |
| **Direct connection** | **ZIP-RS232** | Typical wiring diagram 8 | 1-58 |

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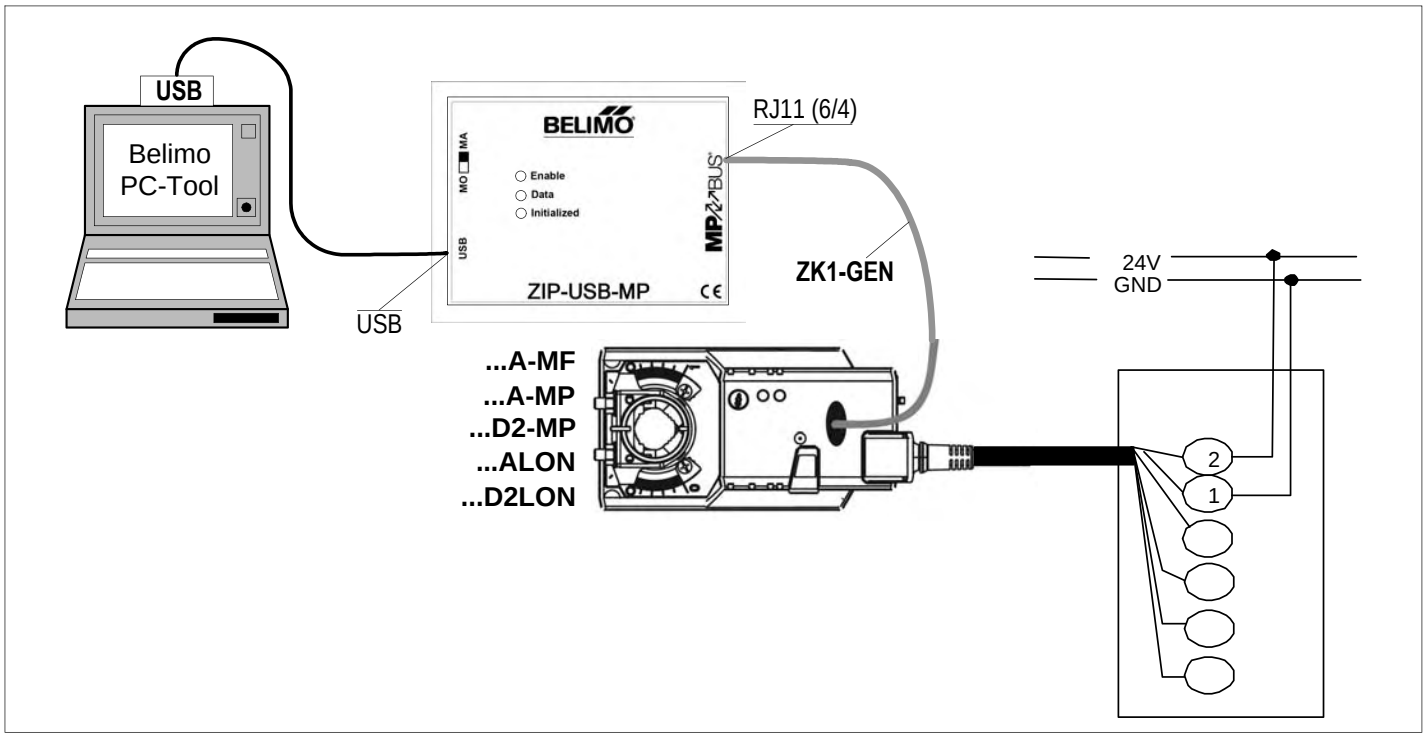
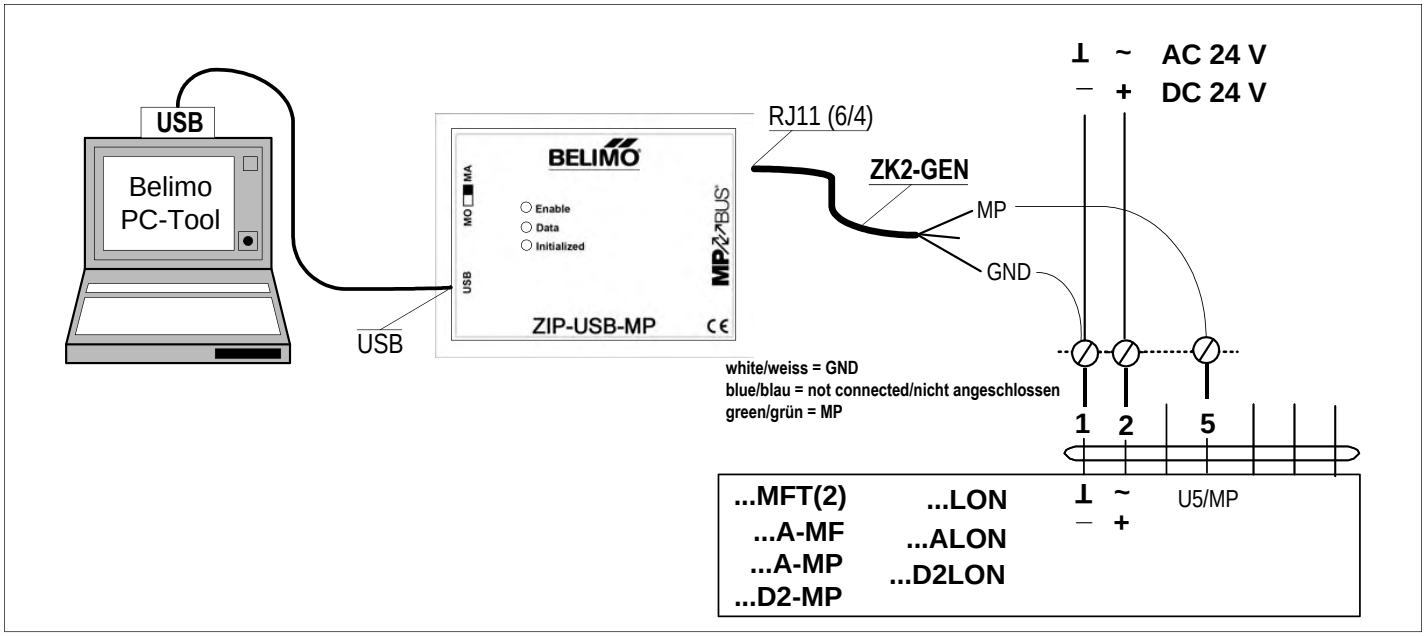
## 4.4.2 Typical wiring diagrams

Typical wiring diagram 1




Typical wiring diagram 2

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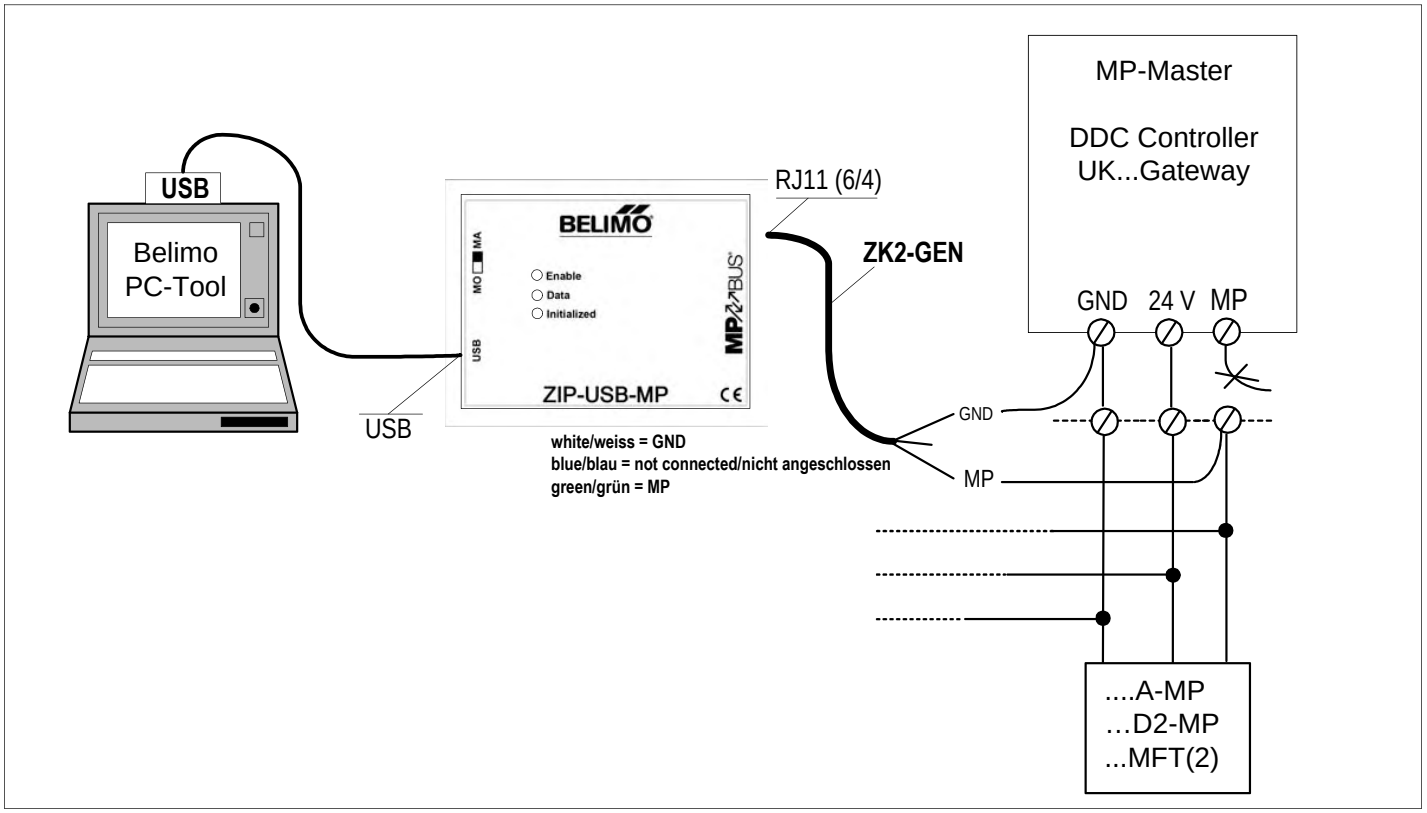
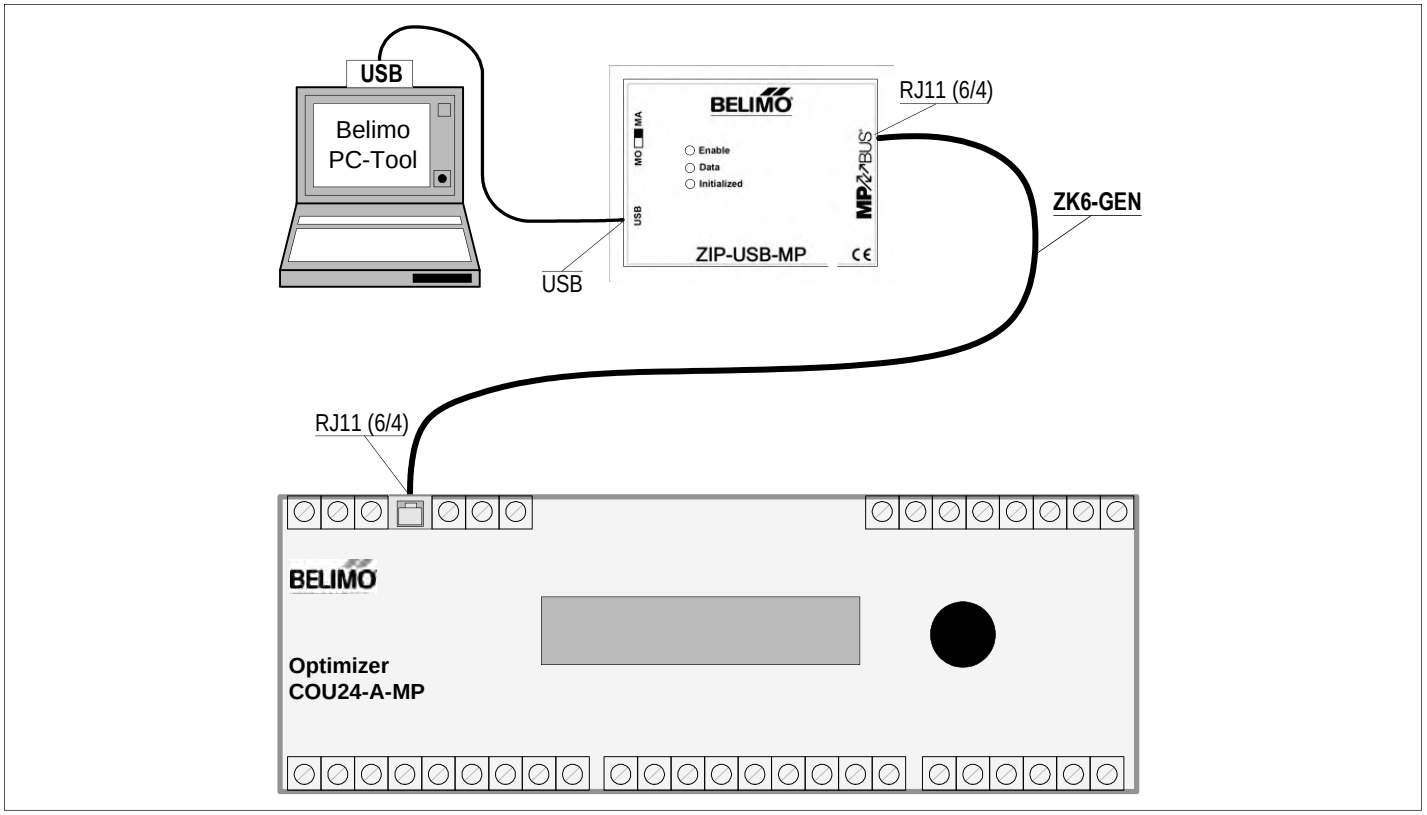
Typical wiring diagram 3




Typical wiring diagram 4

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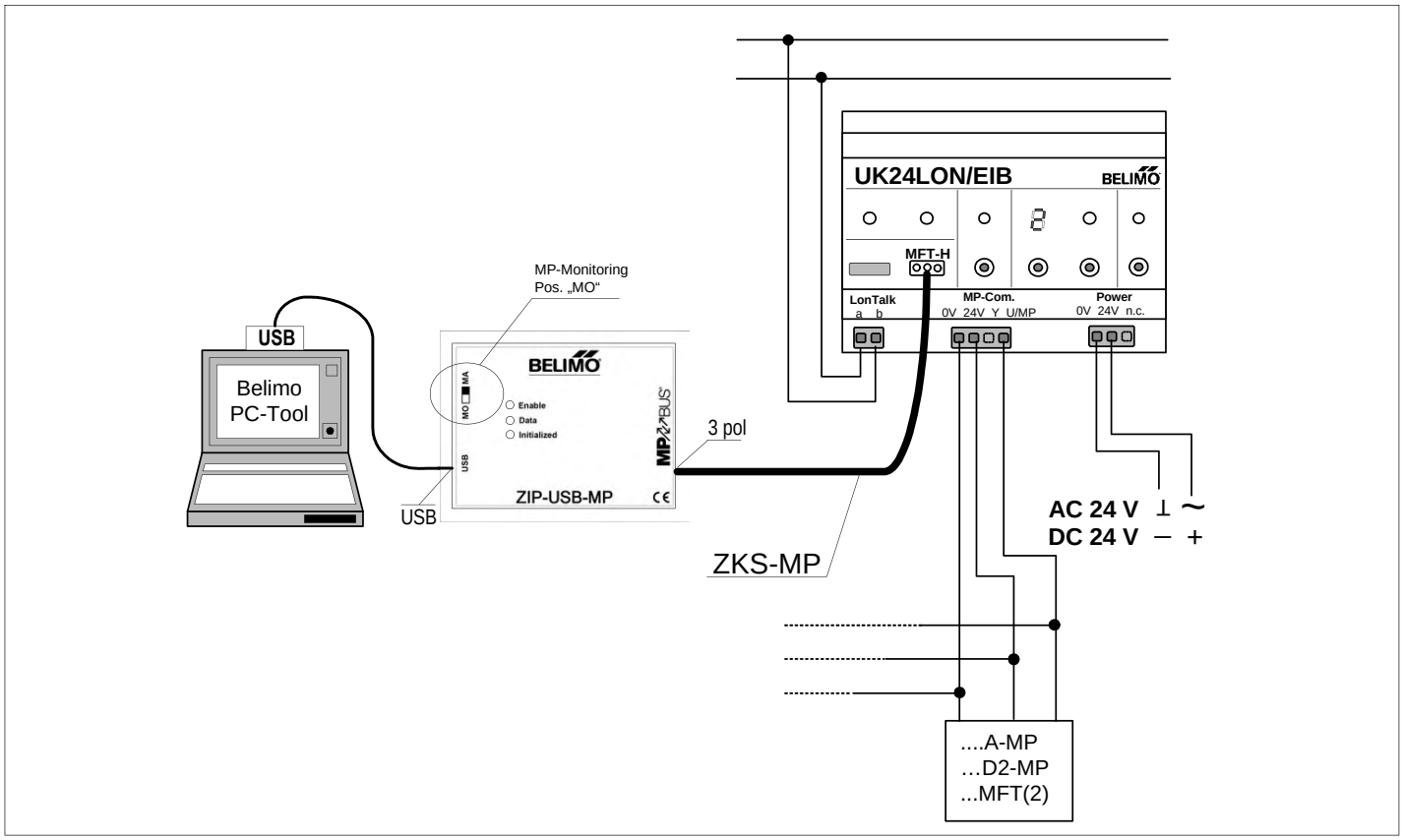
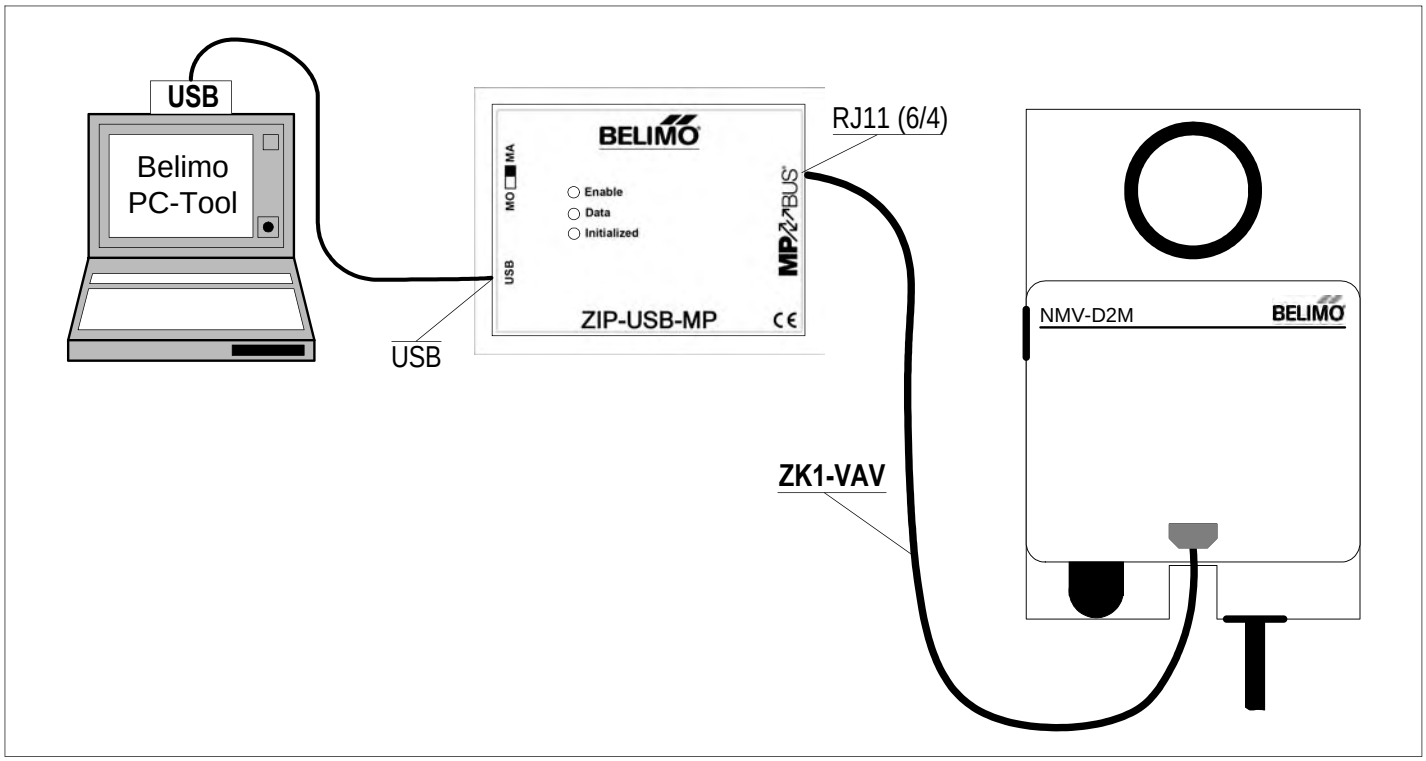
Typical wiring diagram 5




Typical wiring diagram 6

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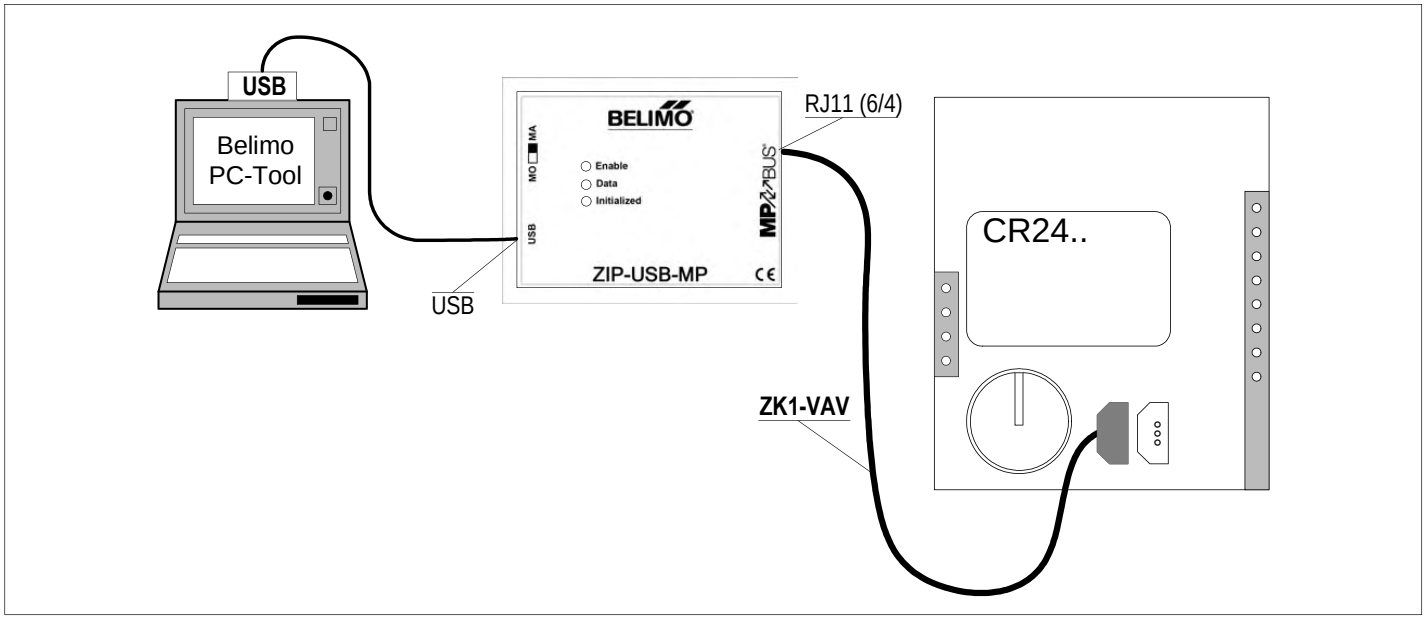
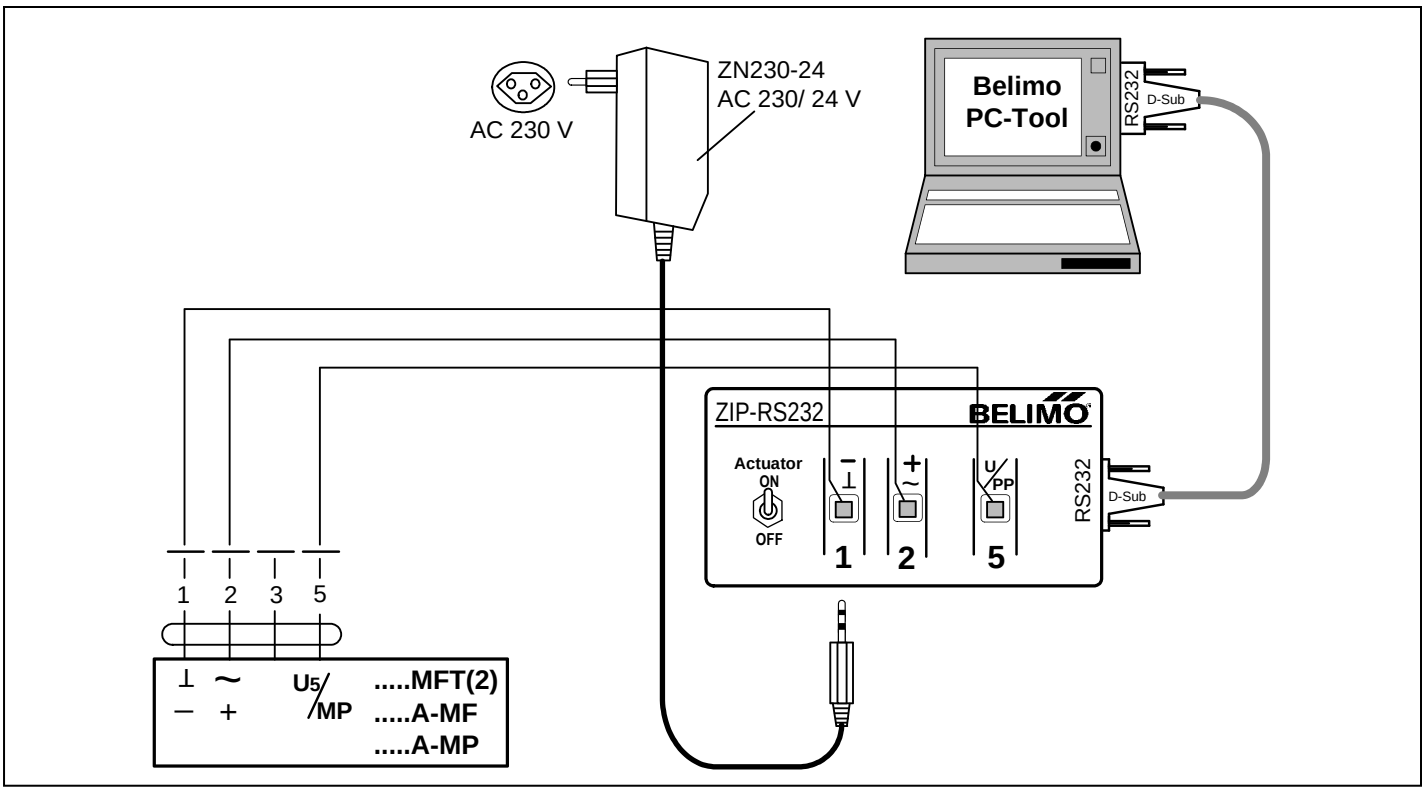
Typical wiring diagram 7




Typical wiring diagram 8

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# Damper and Valve Actuators User Manual

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# 1 Introduction

The "Air module" user manual describes the detail area [D] of the Air module. The documentation is divided according to the three index tabs "Service", "Configuration" and "Simulation".

Air and Water Actuators are basically the same. The water actuator has a linkage that connects the actuator to the valve. The nomenclature of air and water is as follows:

| Air | Water |
|---|---|
| GMB | GRB |
| AMB(Q) | ARB |
| NMB(Q) | NRB |
| LMB(Q) | LRB |

The actuators operate in the same manner. Examples in this document show the damper versions and all data applies to valve actuators as well.

NOTE: NV/NVF actuators section starts on 3-A

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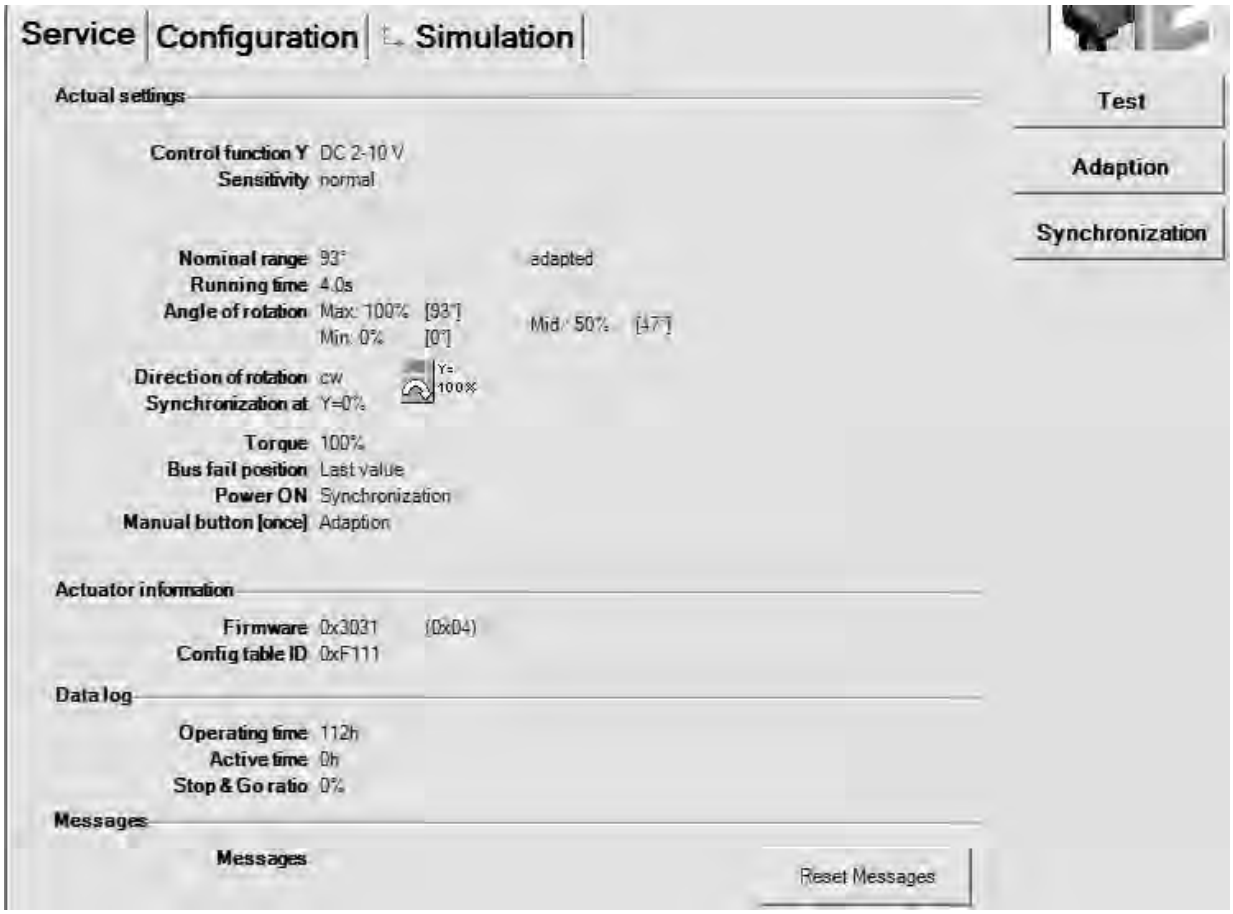
# 2 Service

NOTE: This will display after successfully communicating to the actuator.

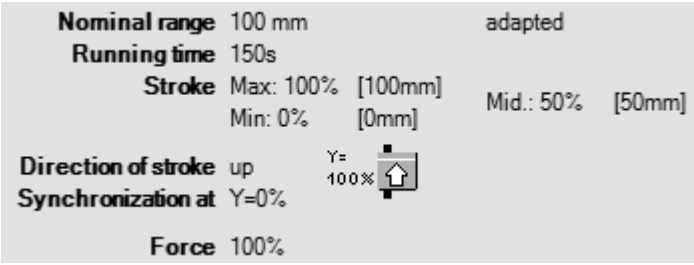
## 2.1 Displaying settings

The Service tab gives an overview of the current settings of the actuator.




*Service tab for full-rotation damper actuators*

For linear actuators the stroke is displayed instead of the angle of rotation, and the torque instead of the positioning force.




*Service tab for linear actuators (excerpt)*

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Meaning of the settings

| Control signal Y | Type of control |
|---|---|
| Sensitivity | Response sensitivity and reversal hysteresis of the control function |
| Feedback U5 | Type of feedback signal |
| Range | Position range within the mechanical limits |
| Running time | related to operating range or a fixed angle/stroke of 95°/100mm (with annotation) |
| Angle of rotation | Programmed rotation range: Min / Mid / Max<br>(for full-rotation actuators) |
| Stroke | Programmed stroke range: Min / Mid / Max<br>(for linear actuators) |
| Direction of rotation | Clockwise/counterclockwise (for full-rotation actuators) |
| Direction of stroke | Up / down (for linear actuators) |
| Synchronization at | Stop position 0 % or 100 % |
| Torque | In percent of the maximum torque (for full-rotation actuators) |
| Actuating force | In percent of maximum positioning force (for linear actuators) |
| Behavior in the event of bus failure | Behavior when communication fails |
| Power ON | Behavior when the system is switched on |
| Manual button [once] | Function when pressed once |
| Manual button [twice] | Function when pressed twice<br>(not present in "New Generation" actuators) |
| Function table | Assignment of override setting and override function<br>*(only for certain actuators)* |
| Firmware | Software version on the actuator |
| Config table ID | Identification of the configuration table |
| Operating time | Number of hours during which the actuator was connected to the power supply |
| Active time | Number of hours during which the actuator was mechanically in motion and connected to the power supply |
| Stop & Go ratio | Ratio of active time/operating time in percent. A high Stop & Go ratio indicates an unstable control. |

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## 2.2 Adaptation

In the adaptation, the actuator determines the range 0% ... 100% by approaching the mechanical limits.

Click the "Adaptation" button on the Service tab.

Option You can also trigger the adaptation directly on the actuator. The necessary buttons for this can be programmed. For example, "Manual button [twice]" can be assigned the adaptation function.

The progress of the adaptation is displayed in the status line. The actuator first moves against the programmed direction to the zero stop and then to the end stop at the full angle of rotation.

Next, the absolute values for a programmed limited angle of rotation range (minimum, mid-position, and maximum) as well as the feedback signal U5 are recalculated and displayed.

## 2.3 Synchronization

In the case of synchronization, a mechanical limit is moved to in order to determine the absolute range.

For each actuator, it is possible to program whether synchronization will take place at the zero stop (0%) or at the full angle of rotation/stroke (100%).

Click the "Synchronization" button on the Service tab.

Option You can also trigger the synchronization directly on the actuator. The necessary buttons for this can be programmed. For example, "Manual button [once]" can be assigned the synchronization function.

The progress of the synchronization is displayed in the status line. With the setting Synchronization at: Y=0%, the actuator moves against the programmed direction to the zero stop, and with the setting Synchronization at: Y=100% to the end stop at the full angle of rotation/stroke.

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Function test

The function test checks for opening and closing.

First of all, the drive moves to the mechanical stop according to the synchronization position. If the angle of rotation (or stroke) is set to "adapted", movement takes place to the other stop; with "programmed", on the other hand, to the programmed range limit.

Click the "Test" button on the Service tab. The standard display is covered by the test window.

*Display of test progress and test report*

Click the "Start Test" button.

The progress and the current position are continuously displayed.

The test report contains

- information on the project,
- the identification of the actuator,
- a list of fault messages pending before the start of the test,
- the test steps and the test results, and
- the current actuator settings.

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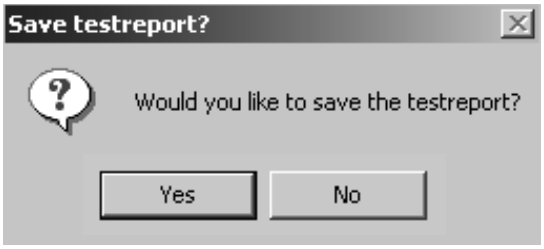
If the test reports an invalid actuator configuration, go to the "Configuration" tab after ending the test. The values that are not allowed are marked with a flashing exclamation point.

You can save the test report as a file by clicking the floppy disk icon, and you can print it with the printer icon.

End the function test with the "Close Test" button. The program asks whether you want to save an unsaved test report now.




If you cancel the test early, the actuator will be reset to its original state. No test report will be created.

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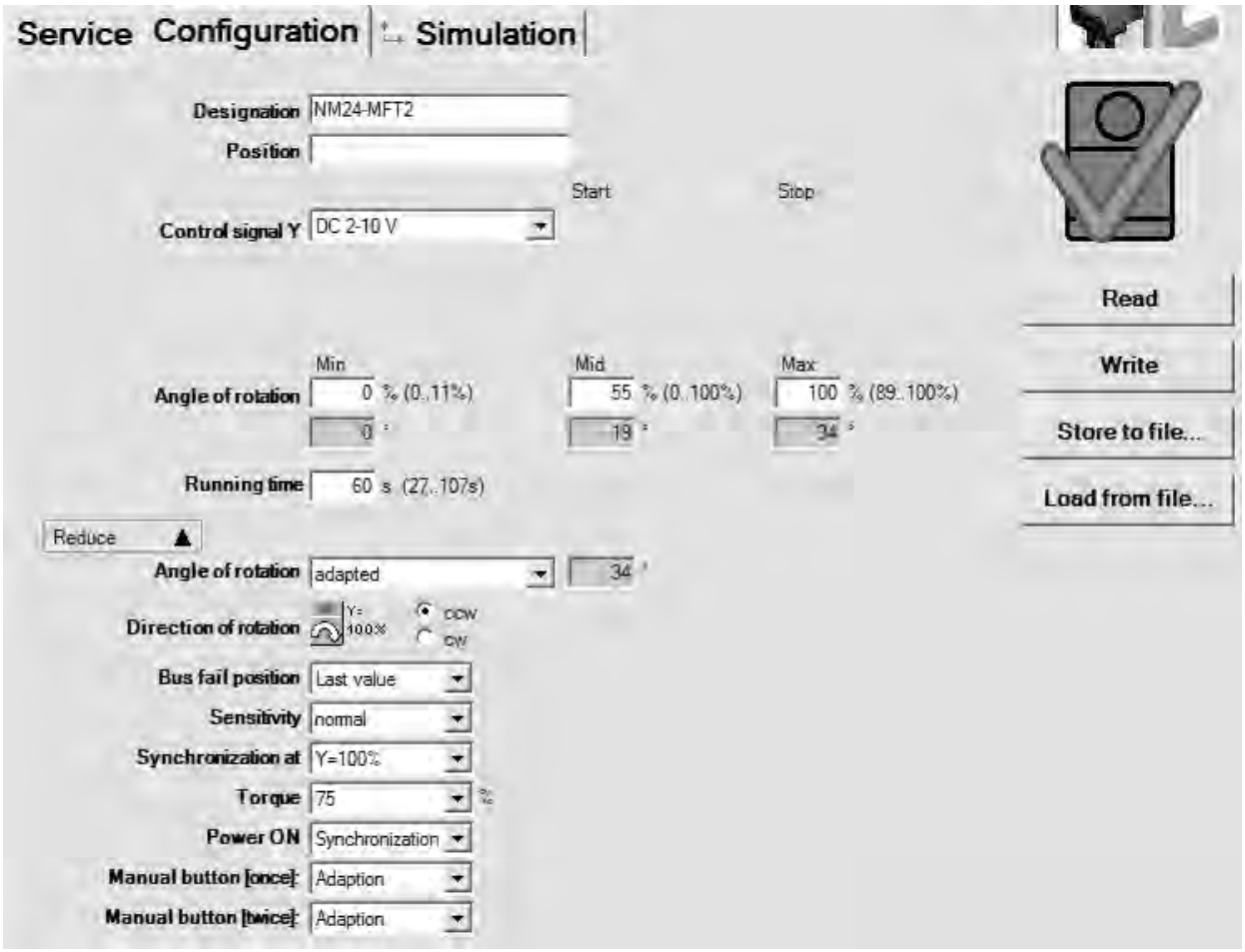
# 3 Configuration

On the "Configuration" tab, you can read out parameter values from the actuator, change them and save them back to the actuator. The valid ranges for the parameter values are displayed in parentheses next to the input boxes.




*"Configuration" tab for full-rotation damper actuators*

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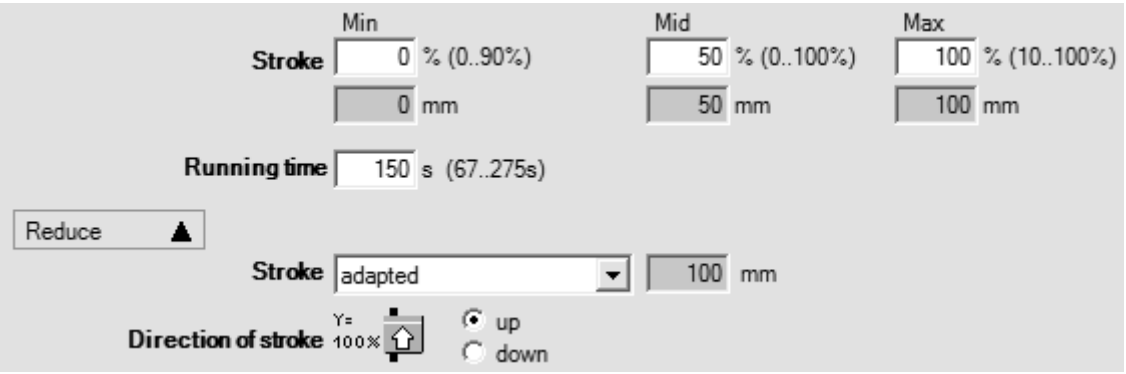
For linear actuators, the stroke is displayed instead of the angle of rotation and the stroke direction instead of the direction of rotation.




*"Configuration" tab for linear actuators (excerpt)*

Actuator number

| | |
|---|---|
| Description | 16 characters of any text |
| Position | 16 characters of any text |

Control signal Y

| | |
|---|---|
| 3-point | AC voltage, positions: Open / neutral / closed |
| Open / closed | DC or AC voltage, 2-point |
| DC 0–10 V | (DC voltage)<br>Fixed operating range DC 0–10 V |
| DC 2–10 V modulating | (DC voltage)<br>Fixed operating range DC 2–10 V |
| DC variable | Start (Y=0%) 0.5 ... 30 V<br>Stop (Y=100%) 2.5 ... 32 V<br>Range between start and stop at least 2 V |
| PWM 0.02–5 s | Duration of the control pulse (pulse width modulation),<br>fixed operating range |
| PWM 0.1–25.5 s | Duration of the control pulse, fixed operating range |
| PWM 0.59–2.93 s | Duration of the control pulse, fixed operating range |
| PWM variable | Start (Y=0%) minimum 0.02 seconds<br>Stop (Y=100%) maximum 50 seconds |

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| | |
|---|---|
| VAV 4 +/- 6 V | When this function is selected, the actuator is parameterized as a VAV actuator and can therefore be controlled by the VAV controllers VR.. .<br><br>Note:<br>When VAV (6 ± 4 V) is selected, the values for minimum, maximum, intermediate value, running time and angle of rotation/stroke are reset to the default values. |
| 4–20 mA | (Direct current)<br>Fixed operating range DC 4–20 mA<br><br>Note:<br>This selection is only available for certain drives (e.g. "SunYeh") |
| mA variable | (Direct current)<br>The values for start and stop are specified in the actuator and cannot be changed with the PC-Tool.<br><br>Note:<br>This selection is only available for certain drives (e.g. "Butterfly Actuators") |

Feedback U5 (only active when the actuator address is set to PP)

| | |
|---|---|
| Damper position,<br>2–10 V | DC voltage measurement signal, fixed range |
| Damper position,<br>0.5–10 V | DC voltage measurement signal, fixed range |
| Damper position,<br>variable | DC voltage measurement signal<br>Start 0.5...8.0 V / Stop 2.5 ... 10.0 V<br>Range between start and stop at least 2 V |
| Damper position,<br>4–20 mA | Direct current measurement signal, fixed range |
| ... | *Certain actuators can define further feedbacks, which you cannot change, however.* |

U5 scaling (only with "New Generation" actuator, MFT or MP types)

| | |
|---|---|
| Start | Position in percent, corresponds to the start value of the feedback signal |
| Stop | Position in percent which corresponds to the stop value of the feedback signal |

Angle of rotation (for full-rotation actuators)
Stroke (for linear actuators)

| | |
|---|---|
| Min | Programmed lower limit of the range |
| Mid | Mid-position of range |
| Max | Programmed lower limit of the range |

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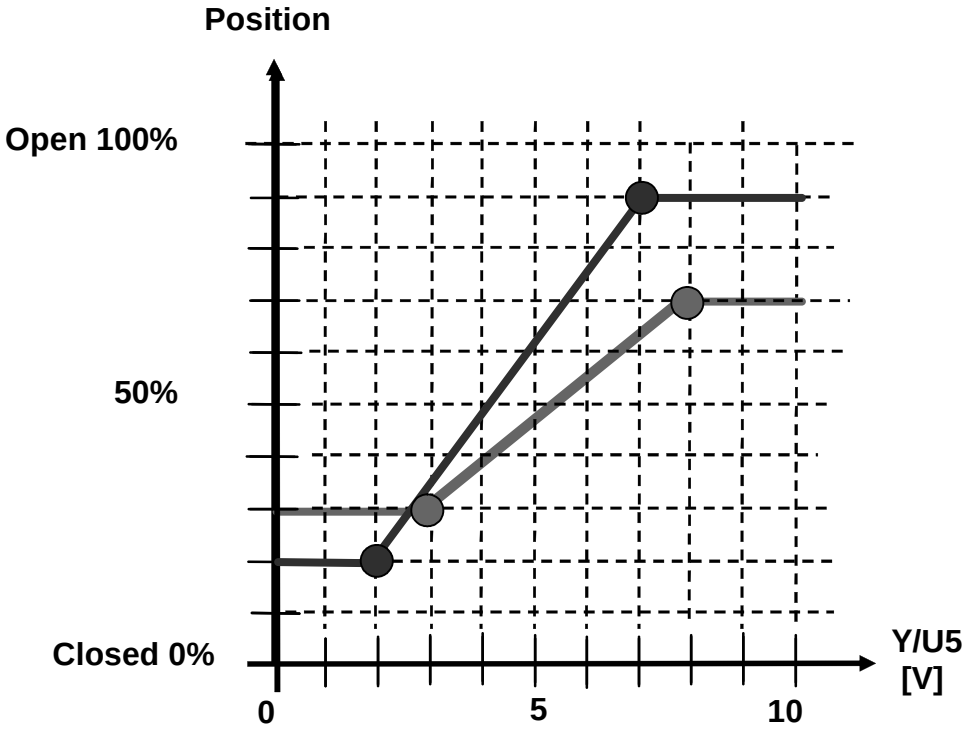
An existing value for Mid is automatically adapted when Min and Max are entered: If you enter Min, Mid is always larger than or equal to this input value. If you enter Max on the other hand, Mid is always less than or equal to this value.

Examples of settings for control signal Y / feedback U5

**Control signal Y:** 3...8 V min: 30%, max : 70%
**Feedback U5 :** 2...7 V start: 20%, stop: 90%




Running time

| | |
|---|---|
| In seconds | Time needed to pass through the range limited by Min and Max (the valid range of values for the running time depends on the actuator type and the passed-through range). |

Note: For actuators with the "constant speed" operating mode, the speed does not depend on the range passed through. The running time refers to a fixed angle of 95° for rotary actuators or a fixed stroke of 100 mm for linear actuators.

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Angle of rotation (for full-rotation actuators) / Stroke (for linear actuators)

| | |
|---|---|
| Adapted | from the mechanical limits of certain angle of rotation range/stroke |
| Programmed | Angle of rotation range (full-rotation) or stroke (linear), the valid values depend on the maximum nominal setting range of the actuator |

Direction of rotation (for full-rotation actuators)

| | |
|---|---|
| cw | Damper opening in the clockwise direction |
| ccw | Damper opening in counterclockwise direction |

Stroke direction (for linear actuators)

| | |
|---|---|
| open | Upward-opening damper (relative to the orientation of the lettering on the actuator) |
| down | Downward-opening damper |

Behavior in the event of bus failure

| | |
|---|---|
| Last setpoint | Position according to control signal Y |
| Open | Move to full angle of rotation/stroke (100 %) |
| Close | Move to zero stop |
| Close quickly | Close with maximum speed |

Sensitivity

| Sensitivity | Actuators without spring-return:<br>NM24-MFT(2)<br>AM24-MFT(2)<br>GM24-MFT(2) | Actuators with spring return:<br>TF24-MFT<br>LF24-MFT(2)<br>NF24-MFT<br>AF24-MFT(2) | Actuators of the new generation and linear:<br>..MF<br>..MP<br>..LON |
|---|---|---|---|
| Normal | | | |
| – Response sensitivity: | 1° angle of rotation | 1° angle of rotation | 1.0% @ operating range |
| – Reversal hysteresis | 2.5° angle of rotation | 2.5° angle of rotation | 2.5% @ operating range |
| Damped | | | |
| – Response sensitivity: | 2° angle of rotation | 2° angle of rotation | 2% @ operating range |
| – Reversal hysteresis | 5° angle of rotation | 5° angle of rotation | 5% @ operating range |
| Variable<br>(*only available with release code*) | | | |
| – Response sensitivity | -- | -- | adjustable 0% ... 20% |
| – Reversal hysteresis | -- | -- | adjustable 0% ... 20% |

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Synchronization at

| | |
|---|---|
| Y = 0% | Moves to the mechanical limit at zero stop (depending on the direction of rotation / stroke direction) |
| Y = 100% | Moves to the mechanical limit at full angle of rotation (depending on direction of rotation / stroke direction) |

Note: When the nominal setting range is set to "programmed", then the synchronization MUST be carried out at Y=0%.

Torque (for full-rotation actuators) / Positioning force (for linear actuators)

| | |
|---|---|
| 25% ... 100% | Can be set in increments of 25%. 100% corresponds to the maximum torque / the maximum positioning force for the actuator type (see nameplate) |

Power ON

| | |
|---|---|
| Synchronization | Moves to a mechanical limit (according to the setting "Synchronization at") |
| Adaptation | Moves to both mechanical limits and recalculates angle-dependent parameters |
| Nothing | (This option is not available for actuators of the "TOP" performance class. When switched on, they must always be adapted or synchronized) |

You can programmatically limit the rotation and stroke range at one end by only changing the minimum or the maximum. If the value of Power ON is set to "Nothing", then the following holds true:

> *The mechanical limit that can still be attained within a rotation range limited at one end will be used for synchronization.*

If you set the minimum to a value greater than 0%, the zero stop will no longer be in the range. In this case, synchronization will take place at the end stop of the full damper opening (Y = 100%). If, on the other hand, you set the maximum to a value smaller than 100%, synchronization will take place at the zero stop (Y = 0%).

This is also valid for the case that the nominal setting range is set to "programmed" and the minimum is equal to 0%: The setting "Power ON: Nothing" is allowed.

Synchronization when the angle of rotation/stroke is limited at both ends

If the minimum is greater than 0% AND the maximum is smaller than 100%, then you can select where the synchronization will take place. In this case, it is necessary to perform synchronization or adaptation when you switch the device on (the setting "Power ON: Nothing" is considered an error).

If the nominal setting range is set to "programmed" and the minimum is greater than 0%, then the same rule applies: At least one synchronization must be programmed.

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Manual button [once]/[twice]

| | |
|---|---|
| Synchronization | Moves to a mechanical limit (according to the setting "Synchronization at") when the manual button is pressed once or twice respectively |
| Adaptation | Moves to both mechanical limits and recalculates angle-dependent parameters when the manual button is pressed once or twice respectively |

Note: For "New Generation" actuators (types MFT, MP), the function Manual button [twice] is not available.

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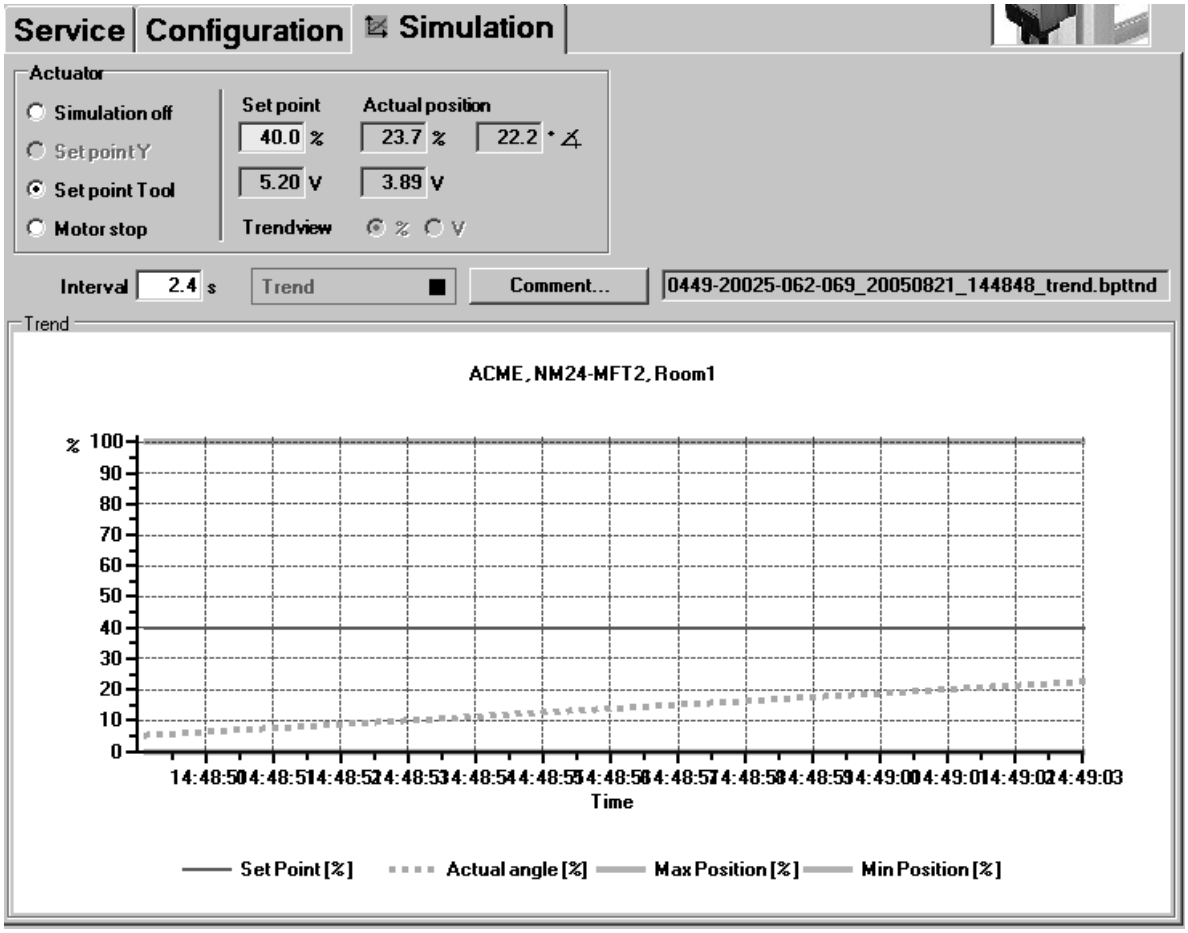
# 4 Controller simulation

Go to the "Simulation" tab.




*Simulation tab for damper actuators*

The controller simulation is not possible while the actuator is performing an adaptation or synchronization.

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## 4.1 Actuator control

Select the type of setpoint definition with the radio buttons.

- Setpoint Y (only available in PP mode): Control signal at connection Y according to selected control type (DC, PWM, open/close, 3-point).

Setpoint Tool (not available with control type open/close or 3-point): The setpoint is entered in % of the programmed range. 0% is the minimum, 100% the maximum. The input values are converted and displayed in the units of the corresponding control signal (volts, milliamps or seconds).

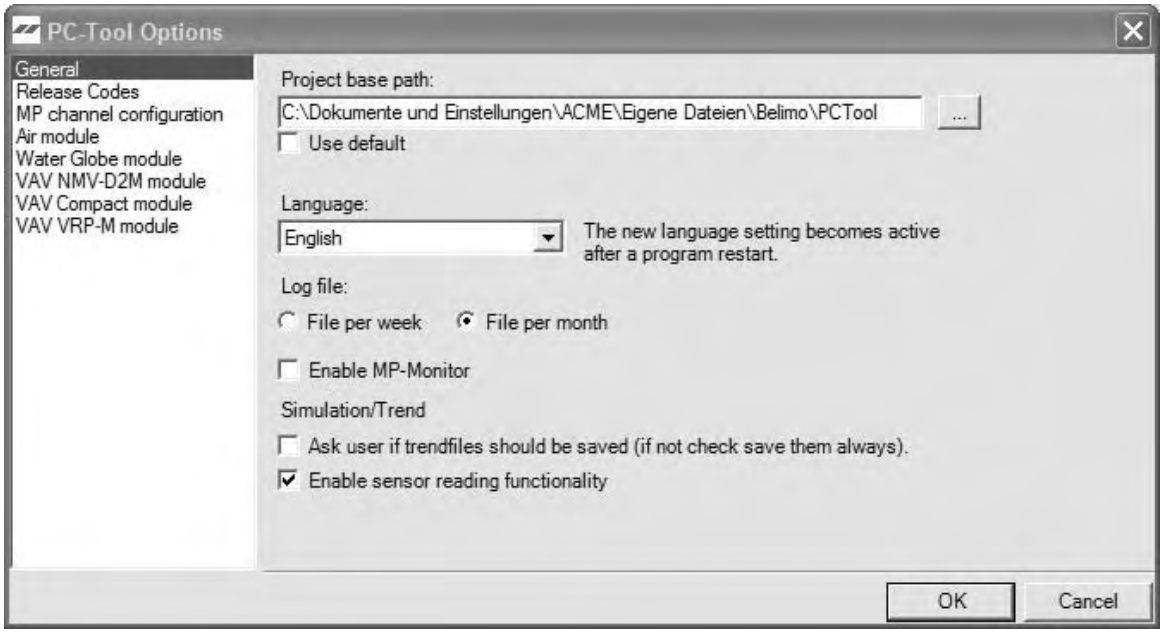
The control is switched off when you click "Motor stop". This function is not available with the control types open/close and 3-point.

Measurement values

During the simulation, the current angle of rotation or stroke is displayed in % of the absolute (mechanically limited) range and – converted according to the scale setting – as a feedback value in volts or milliamps.

## 4.2 Reading out sensors and switches

The values of sensors and switches can be read out in MP mode. This function, however, must be activated in advance in the PC-Tool options under "General". Select Tools ▸ Options in the main menu.




*Settings for reading out sensors*

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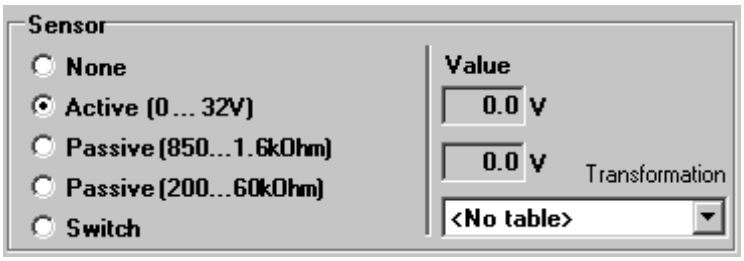
On the Service tab, a section with the sensor values is displayed to the right of the actuator control.




*Sensor display in MP mode*

Select the type of the connected sensor with the radio buttons. The value is either displayed in volts (active), ohms (passive) or as on/off (switch).

The transformation table allows you to additionally convert the raw value of the sensor into the corresponding measuring quantity (temperature etc.). (See the "Transformation table" section in the General User Manual)

## 4.3 Trend recording

During simulation, the time progress of the setpoints and actual values can be displayed in a plot. The values are saved in a trend file and can be displayed again at a later time. Furthermore, you can add any comment texts you would like.

In the PC-Tool options "General", you determine whether the trend file is automatically saved when the recording is finished (checkbox not selected) or whether the program should ask you. The suggested file name can be modified before saving the file.

Click the "Trend Record" button during simulation. The display changes to a "flat" button. The recording stops when you click again.

The Trend View radio buttons allow you to set whether the display is given in percent of the full range (%) or in volts (V).

The position is queried every second by default. You can change the query interval in an input box. The permitted values are 0 to 9999 seconds, whereby the value 0 means "no waiting time" (query as quickly as possible).

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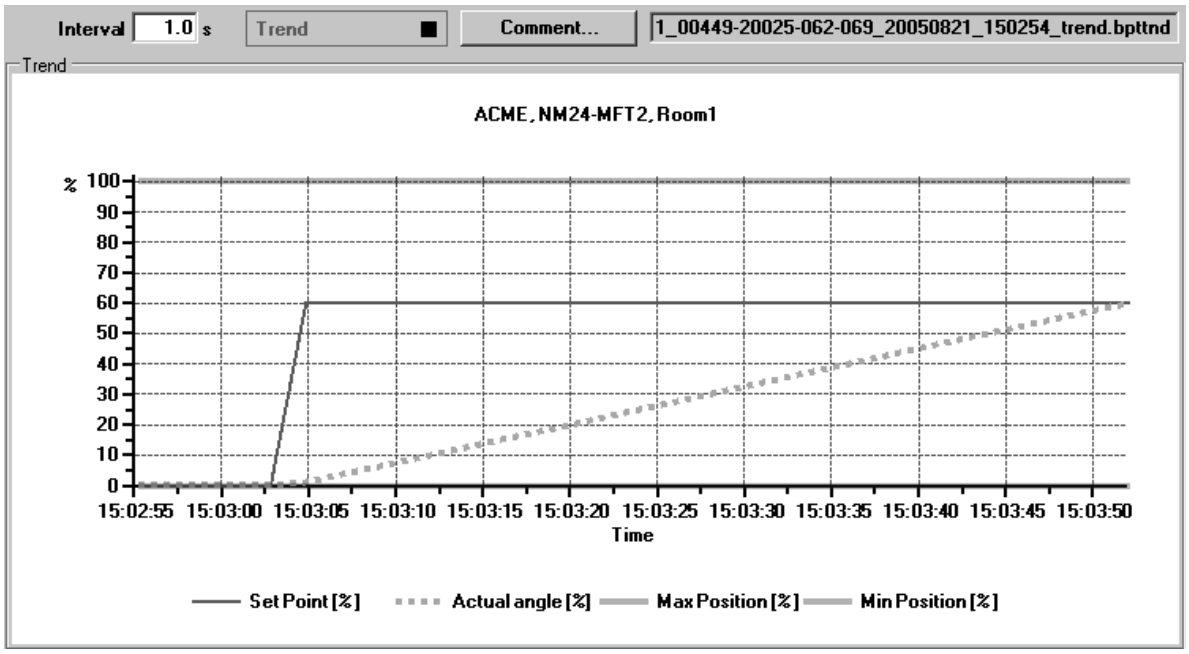


*Trend plot*

The Comment button allows you to enter a text at a defined time and the text is then saved in the trend file.

If you want to record a trend for more than one hour (long-term trend), enter a value of at least 2 seconds for the interval. If the interval is shorter, too many data points will result and the time for correcting the curve between the queries can become too short.

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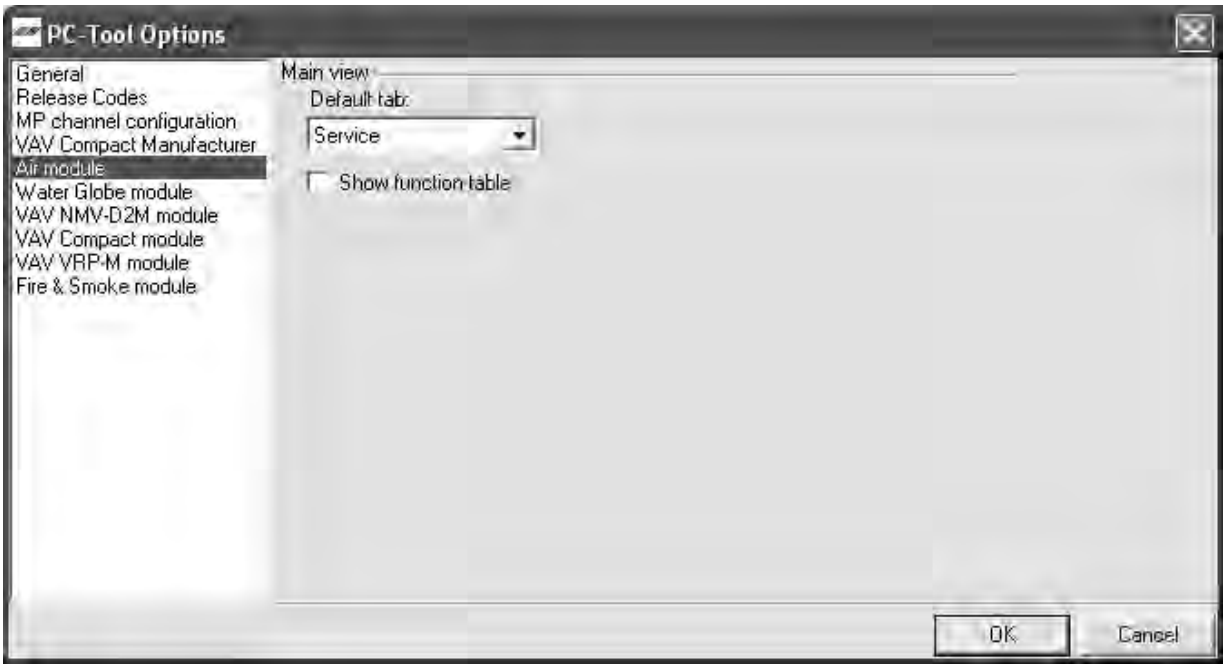
# 5 PC-Tool options

Select Tools ▸ Options in the main menu.

Option Click the right mouse button on the program icon in the outline bar and select "Options".




*Dialog for basic settings (Air module)*

Select "Air module" on the left.

Using the combobox "Default tab", you can select the index tab you want to open by default when starting the program PC-Tool.

If you would like to show the function table in the Configuration register, activate the “Show function table“ checkbox.

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# NV/NVF Series Actuators User Manual

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# 1 Introduction

The "Water module" user manual describes the detail area [D] of the Water module for globe valve actuators. The documentation is divided according to the three tabs "Service", "Configuration" and "Simulation".

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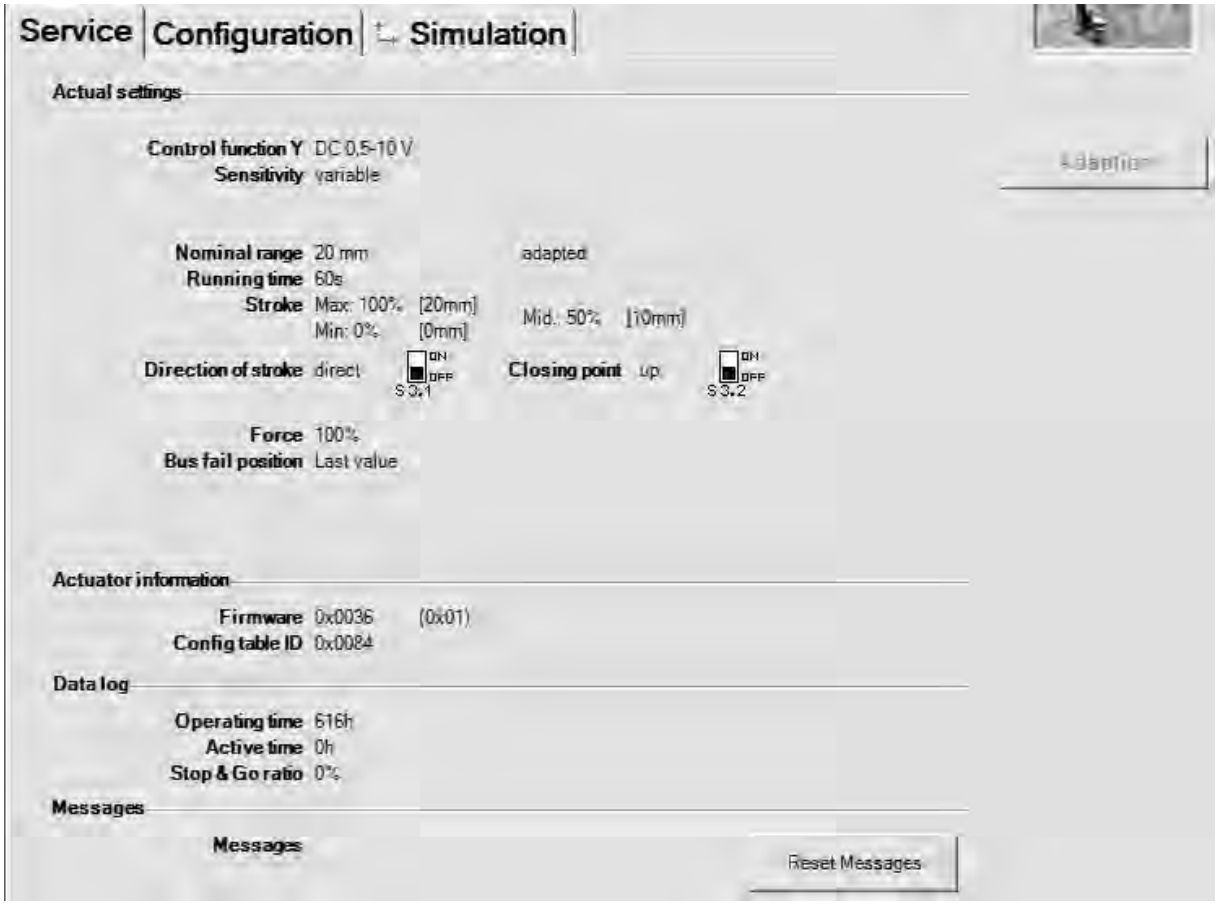
# 2 Service

## 2.1 Displaying settings

The Service tab gives an overview of the current settings of the actuator.




*Service tab for NV/NVF valve actuators*

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Meaning of the settings

| | |
|---|---|
| Control signal Y | Type of control |
| Sensitivity | Response sensitivity and reversal hysteresis of the control function |
| Feedback U5 | Type of feedback signal |
| Range | Position range within the mechanical limits |
| Running time | Time needed to pass through the position range |
| Stroke | Programmed stroke range: Max / Mid / Min |
| Direction of rotation | Clockwise/counterclockwise (for full-rotation actuators) |
| Direction of stroke | Plot of stroke direction to the positioning signal: Direct / inverted (in acc. with switch S3.1) |
| Switching point | Top / bottom (in acc. with switch S3.2) |
| Actuating force | In percent of the maximum positioning force |
| Behavior in the event of bus failure | Behavior when communication fails |
| Firmware | Software version on the actuator |
| Config table ID | Identification of the configuration table |
| Operating time | Number of hours during which the actuator was connected to the power supply |
| Active time | Number of hours during which the actuator was mechanically in motion and connected to the power supply |
| Stop & Go ratio | Ratio of active time/operating time in percent. A high Stop & Go ratio indicates an unstable control. |

Running time, range, direction of rotation and stroke are not displayed on certain actuators.

## 2.2 Adaptation

In the adaptation, the actuator determines the range 0% ... 100% by approaching the mechanical limits.

Click the "Adaptation" button on the Service tab.

Variant You can also trigger the adaptation directly on the actuator. To do this, you have to remove the cover from the actuator. To trigger the adaptation, press the S2 button on the electronic PCB.

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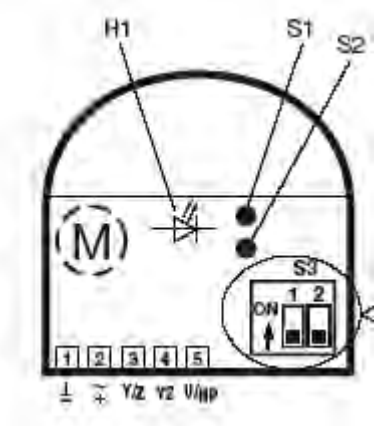


*Control element diagram with open linear actuator*

The progress of the adaptation is displayed in the status line. The actuator first moves against the programmed direction to the zero stop and then to the end stop at full stroke.

Next, the absolute values for a programmatically limited angle of rotation range (minimum, mid-position, and maximum) as well as the feedback signal U5 are recalculated and displayed.

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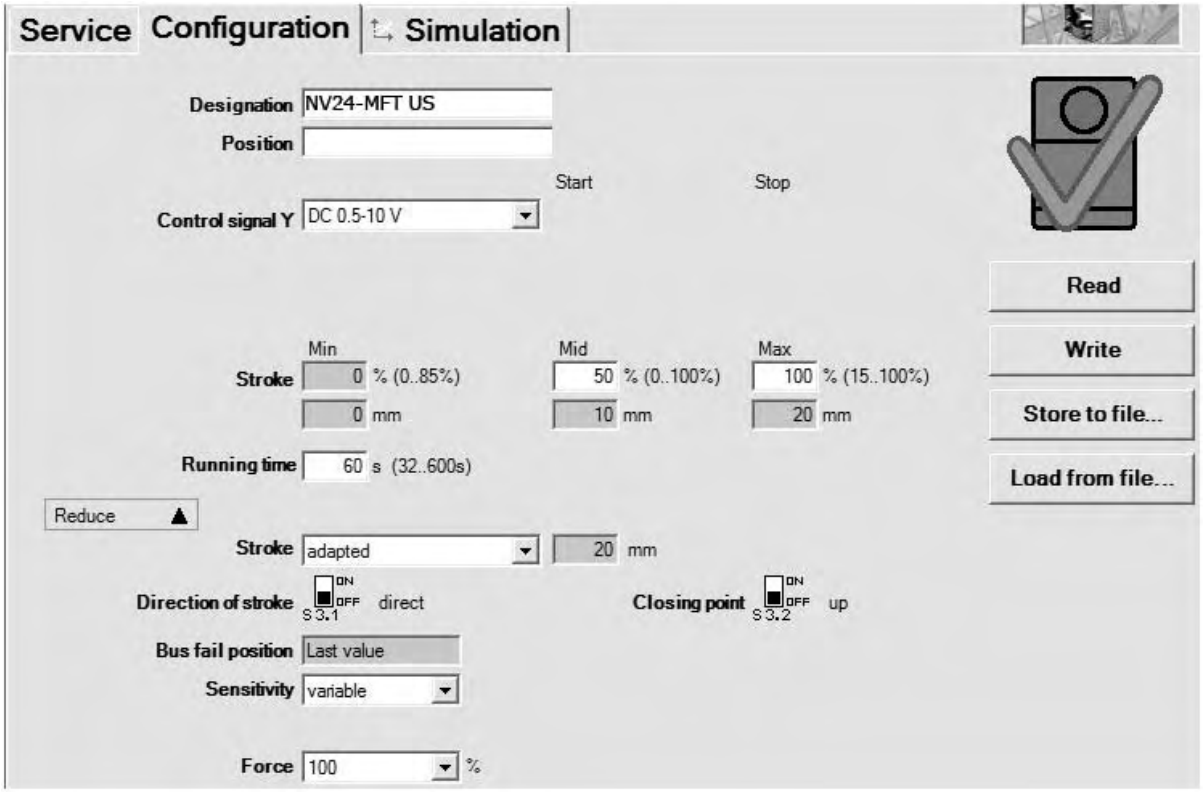
# 3 Configuration

On the "Configuration" tab, you can read out parameter values from the actuator, change them and save them back to the actuator. The valid ranges for the parameter values are displayed in parentheses next to the input boxes.




*"Configuration" tab for globe valve actuators*

Actuator number[1]

| | |
|---|---|
| Designation | 16 characters of any text |
| Position | 16 characters of any text |

[1] Only characters from the Western European character set are permitted for Description and Position (see General part, table in Section 4.3.3).

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Control signal Y

| | |
|---|---|
| 3-point | AC voltage, positions: Open / neutral / closed |
| Open / closed | DC or AC voltage, 2-point |
| DC 0.5–10 V | (DC voltage)<br>fixed operating range DC 0.5–10 V |
| DC 2–10 V modulating | (DC voltage)<br>fixed operating range DC 2–10 V |
| DC variable | Start (Y=0%) 0.5 ... 30 Volt<br>Stop (Y=100%) 2.5 ... 32 Volt<br>Range between start and stop at least 2 V |
| PWM 0.02–5 s | Duration of the control impulse (pulse width modulation),<br>fixed operating range |
| PWM 0.1–25.5 s | Duration of the control pulse, fixed operating range |
| PWM 0.59–2.93 s | Duration of the control pulse, fixed operating range |
| PWM variable | Start (Y=0%) minimum 0.02 seconds<br>Stop (Y=100%) maximum 50 seconds |

Feedback U5 (only active when the actuator address is set to PP)

| | |
|---|---|
| Valve setting 2 -10V | DC voltage measurement signal, fixed range |
| Valve setting 0.5 -10V | DC voltage measurement signal, fixed range |
| Variable valve setting | DC voltage measuring signal<br>Start 0.5...8.0 Volt / Stop 2.5 ... 10.0 V<br>Range between start and stop at least 2 V |

Scaling U5 (with "New Generation" actuator only)

| | |
|---|---|
| Start | Position in percent, corresponds to the start value of the feedback signal |
| Stop | Position in percent which corresponds to the stop value of the feedback signal |

Stroke

| | |
|---|---|
| Min | Programmed lower limit of the range (cannot be changed) |
| Mid | Mid-position of range |
| Max | Programmed lower limit of the range |

An existing value for Mid is automatically adapted when Max is entered: Mid is always less than or equal to this input value.

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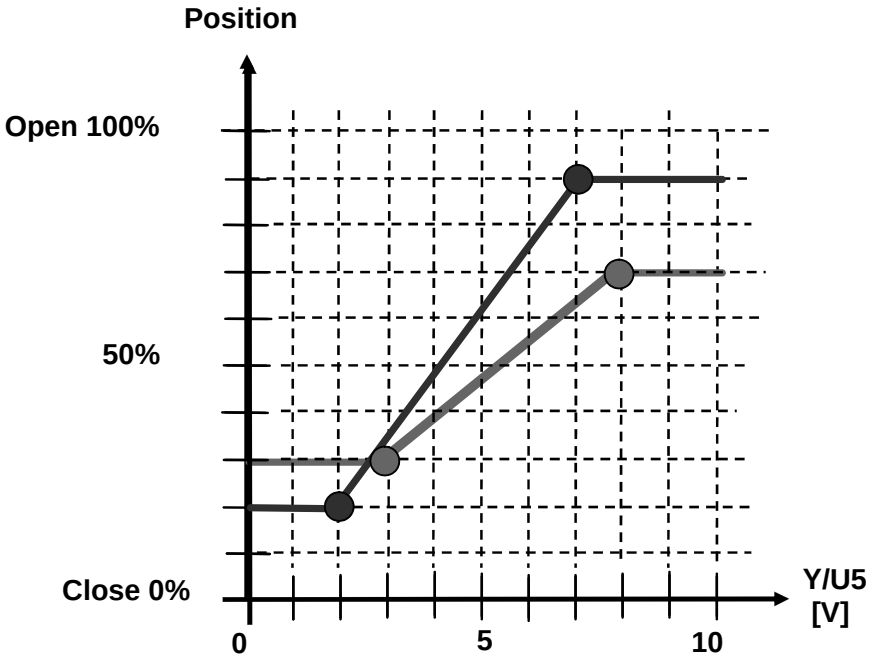
Examples of settings for control signal Y / feedback U5

**Control signal Y:** 3...8 V min: 30%, max : 70%
**Feedback U5 :** 2...7 V start: 20%, stop: 90%




Running time

| | |
|---|---|
| In seconds | Time needed to pass through the range limited by<br>Min and Max (the valid range of values for the running time depends on the actuator type and the passed-through range) |

Stroke

| | |
|---|---|
| Adapted | from the mechanical limits of certain stroke |
| Programmed | The valid values depend on the maximum nominal positioning range of the actuator |

Stroke direction (in acc. with switch S3.1)

| | |
|---|---|
| Direct | 0% positioning signal is equivalent to 0% position feedback. |
| inverted | 0% positioning signal is equivalent to 100% position feedback. |

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Closing point (in acc. with switch S3.2)

| | |
|---|---|
| top | The linear spindle is moved into the actuator with the valve closed and the stem is moved out of the fitting. |
| bottom | The linear spindle is moved out of the actuator with the valve closed and the stem is moved into the fitting. |

Behavior in the event of bus failure (currently cannot be changed)

| | |
|---|---|
| Last setpoint | Position according to control signal Y |

Sensitivity

| | |
|---|---|
| Normal | |
| – Response sensitivity: | 1%<br>@ Operating range |
| – Reversal hysteresis | 2.5%<br>@ Operating range |
| Damped | |
| – Response sensitivity: | 2%<br>@ Operating range |
| – Reversal hysteresis | 5%<br>@ Operating range |

Actuating force

| | |
|---|---|
| 25% ... 100% | Can be set in increments of 25%. 100% corresponds to the maximum positioning force for the actuator type (see nameplate) |

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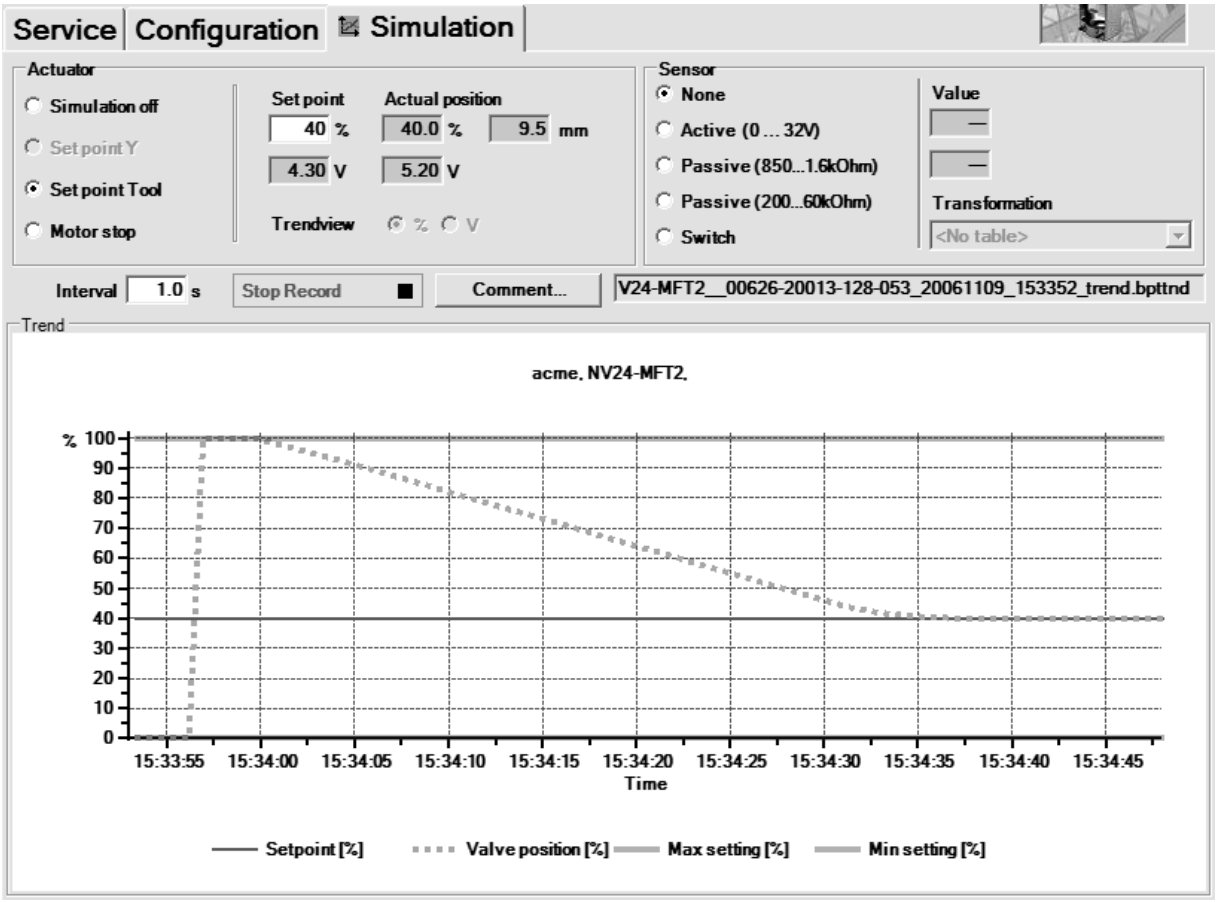
# 4 Controller simulation

Go to the "Simulation" tab.




*"Simulation" tab for globe valve actuators*

The controller simulation is not possible while the actuator is performing an adaptation or synchronization.

## 4.1 Actuator control

Select the type of setpoint definition with the radio buttons.

- Setpoint Y (only available in PP mode): Control signal at connection Y according to selected control type (DC, PWM, open/close, 3-point).
- Setpoint Tool (not available with control type open/close or 3-point): The setpoint is entered in % of the programmed range. 0% is the minimum, 100% the maximum. The input values are converted and displayed in the units of the corresponding control signal (volts or seconds).

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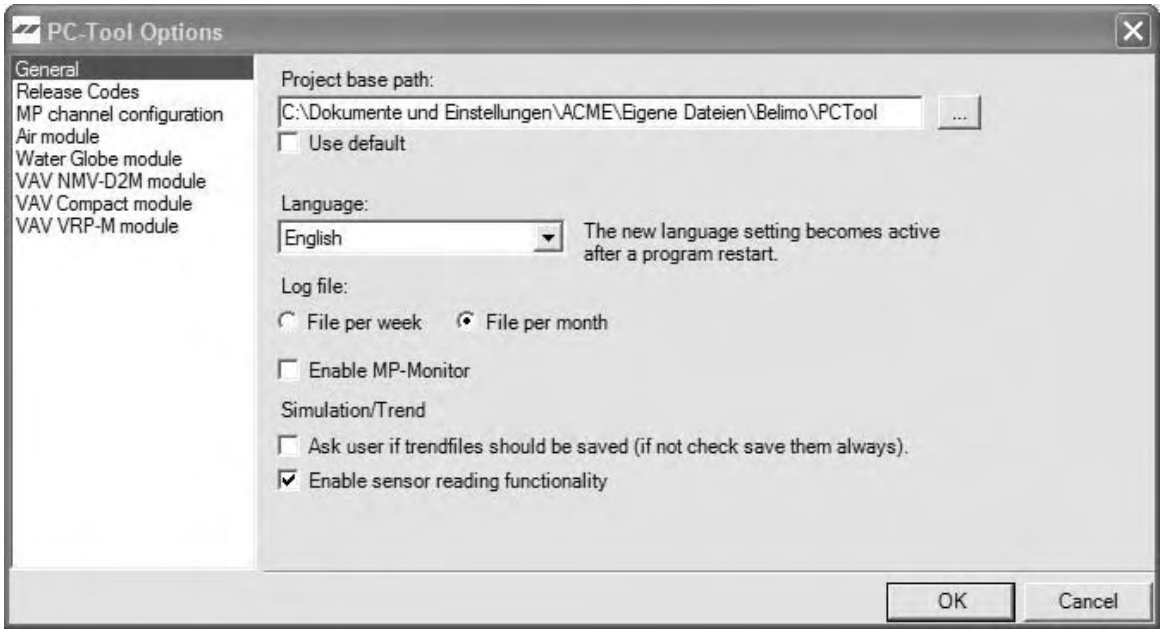
The control is switched off when you click Motor stop. This function is not available with the control types open/close and 3-point.

Measurement values

During the simulation, the stroke is displayed in % of the absolute (mechanically limited) range in millimeters and – converted according to the scale setting – as a feedback voltage in volts.

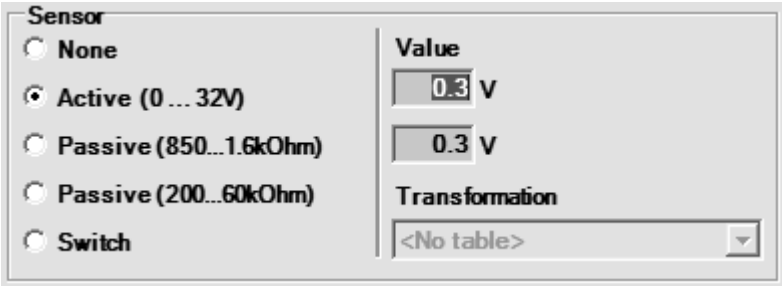
## 4.2 Reading out sensors and switches

The values of sensors and switches can be read out in MP mode. This function, however, must be activated in advance in the PC-Tool options under "General". Select Tools▸PC-Tool options... in the main menu.




*Settings for reading out sensors*

On the Service tab, a section with the sensor values is displayed to the right of the actuator control.




*Sensor display in MP mode*

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Select the type of the connected sensor with the radio buttons. The value is either displayed in volts (active), ohms (passive) or as on/off (switch).

The transformation table allows you to additionally convert the raw value of the sensor into the corresponding measuring quantity (temperature etc…). (See the "Transformation table" section in the General User Manual)

## 4.3 Trend recording

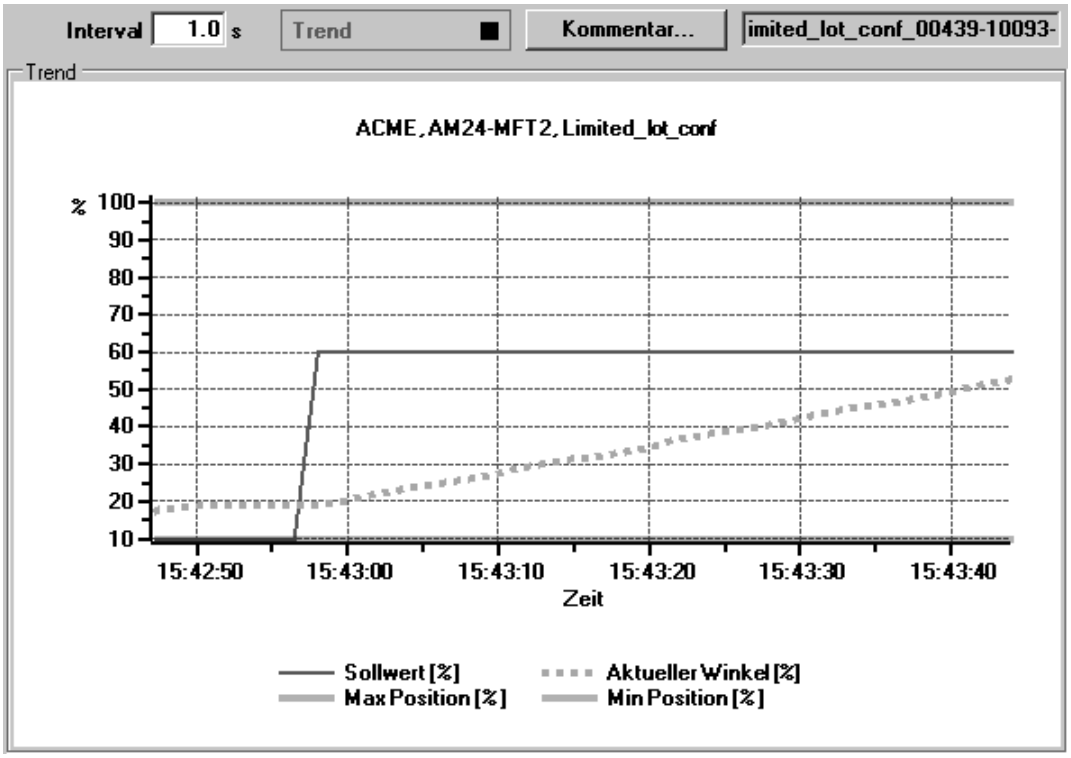
During simulation, the time progress of the setpoints and actual values can be displayed in a plot. The values are saved in a trend file and can be displayed again at a later time. Furthermore, you can add any comment texts you would like.

In the PC-Tool options "General", you determine whether the trend file is automatically saved when the recording is finished (checkbox not selected) or whether the program should ask you. The suggested file name can be modified before saving the file.

Click the "Trend Record" button during simulation. The display changes to a "flat" button. The recording stops when you click again.

The Trend View radio buttons allow you to set whether the display is given in percent of the full rotation range (%) or in volts (V).

The position is queried every second by default. You can change the query interval in an input box. The permitted values are 0 to 9999 seconds, whereby the value 0 means "no waiting time" (query as quickly as possible).




*Trend plot*

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The Comment button allows you to enter a text at a defined time and the text is then saved in the trend file.

If you want to record a trend for more than one hour (long-term trend), enter a value of at least 2 seconds for the interval. If the interval is shorter, too many data points will result and the time for correcting the curve between the queries can become too short.

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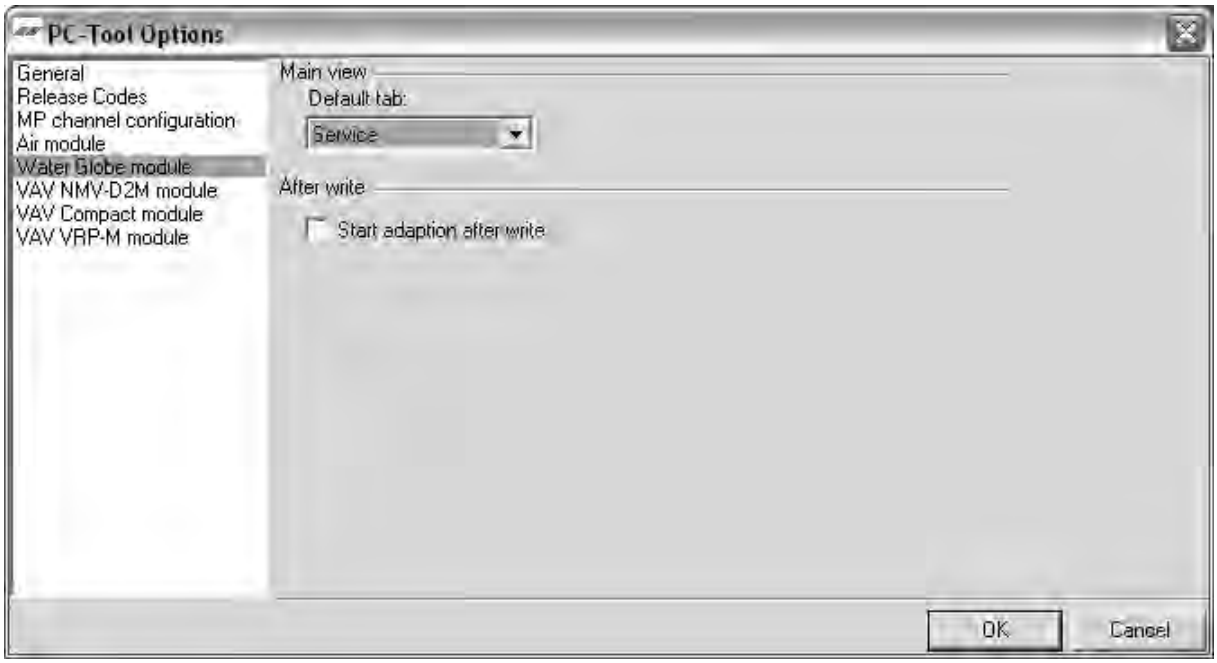
# 5 PC-Tool options

Select Tools▸PC-Tool options... in the main menu.

Variant Click the project in the outline bar [C] with the right mouse button and select PC-Tool options.




*Dialog for basic settings (Water module)*

Select "Water/globe module" on the left.

Using the combobox "Default tab", you can select the index tab you want to open by default when starting the program PC-Tool.

If an adaptation is to be performed after every programming operation, select "Start adaption after write".

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